



AGRICULTURAL RESEARCH INSTITUTE'

PUSA

IZE-ESSAYS
AND
ANS ACTIONS
OF THE
LD AND AGRICULTURAL
SOCIETY OF SCOTLAND.

NEW SERIES.

VOL. V.

WILLIAM BLACKWOOD AND SONS, EDINBURGH ;
AND T. CADELL, STRAND, LONDON.
MDCCXXXVII.

PRINTED BY NEILL & CO. OLD FISHMARKET, EDINBURGH.

PRIZE-ESSAYS

AND

TRANSACTIONS

OF THE

**HIGHLAND AND AGRICULTURAL
SOCIETY OF SCOTLAND.**

VOL. XI.

**WILLIAM BLACKWOOD AND SONS, EDINBURGH;
AND T. CADELL, STRAND, LONDON.**

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CONTENTS.

I. Preliminary Notice,	Page 1	
II. Royal Warrant for a New and Supplemental Charter to the Highland and Agricultural Society of Scotland,	13	
III. Bye-Laws of Highland and Agricultural So- ciety of Scotland,	24	
IV. Essays on the Partial Failure of the Potato Crop of 1833,	27	
1. By Messrs GEORGE and JAMES MACDONALD, Huntly,	27	
2. By Messrs MALKER and WINDER, Liverpool, . .	34	
By Mr ROBERT FAIRBAIRN, Grange Cottage, Causewayside, Edinburgh—Mr JAMES WALDIE, Berbeth Mains, Ayrshire—Mr W. ANDERSON —Mr JOHN McClymont, Balsaggart, Ayr- shire—Mr THOMAS McVITIE, Craigshiels, Dum- friesshire—Mr JAMES WADDELL, Dunoon, Ar- gyllshire—Mr SMITH, Penfillan—Mr JOHN CAUGHY, Belfast—Mr WILLIAM WILSON, Gas- town, Dumfriesshire—Mr JAMES KENNEDY, Lochlands, near Maybole—Mr JAMES JACK- SON, Plaintree Shade, by Penicuik—Mr BRYCE WRIGHT, Woodland, Girvan, Ayrshire—Mr GEORGE HERRON, Kilwinning, Ayrshire—Mr PETER COWAN, Antrim Castle, Ireland—HOR- TULANUS—GENERAL REMARKS,		38-45
V. Note respecting the Cultivation of the Potato. By the Rev. JAMES FARQUHARSON, Alford, . .	48	
VI. Description of an improved Double-Action Pump, for raising water, and an improved Syphon. By Mr MIDDLEMISS, Montrose. . .	49	

VII.	Experiment made on the Comparative Advantages of Feeding Cattle on Raw or Steamed Food. Supplementary to a Report previously published. By Mr ROBERT WALKER, Ferrygate, Haddington,	52
VIII.	Report of the Committee for the Premiums offered in 1833 for Curing of Beef and Pork in the Counties of Lanark, Renfrew, and Dumbarton,	55
IX.	Account of the principal Limestone Quarries of Scotland. By Mr JAMES CARMICHAEL, Raploch Farm, Stirlingshire,	75
X.	Report of Experiments on the Comparative Value of the different Varieties of the Potato. By Mr ANDREW HOWDEN, Lawhead, East Lothian,	85
XI.	Report of the System of Improvement followed on the Muirs of Drumforsk and Drumquhyle, now called Charlestown, in the county of Kincardine, belonging to JOHN MENZIES, Esq. of Pitfodels, by the settlement of Crofters on improving leases, with allotments of a few acres of waste land to each. Communicated by Provost BLAIKIE of Aberdeen,	97
XII.	Report on the Introduction of certain New Forest Trees into the Cultivation of Scotland. By Mr THOMAS BISHOP, Land-Steward, Methven Castle,	121
XIII.	Account of the Island of Arran. By Mr JOHN PATERSON, Factor to his Grace the Duke of Hamilton and Brandon,	125
XIV.	Reports relative to Plantations,	
	1. By GEORGE DEMPSTER, Esq. of Skibo,	155
	2. By COLIN MACKENZIE, Esq. of Kilcoy, Ross-shire,	157

- XV. Description of Mr HUNTER's Patent Stone-Planing Machine, 160
- XVI. Description of a Bridge of Suspension. Constructed by Mr JOHN YOUNG, Brechin, . . 166
- XVII. A Geological Survey of Berwickshire. By DAVID MILNE, Esq. Advocate, Edinburgh, . 171
- XVIII. Description of a Syringe for Smearing and Bathing Sheep. By Mr ROBERT NISBETT, Innerleithen, 254
- XIX. Account of the *Vicia villosa*, a species of Tare new to this Country. By Mr ARCHIBALD GORRIE, Annat Garden, 255
- XX. Account of Alsike Clover (*Trifolium hybridum*). By Mr GEORGE STEPHENS, Land-Drainer, Edinburgh, 256
- XXI. Report made to His Grace the Duke of Buccleuch and Queensberry, relative to the Agricultural Garden formed at Smeaton, in Dalkeith Park, by orders of His Grace. Communicated to the Highland and Agricultural Society of Scotland by directions of the Duke, 259
- XXII. Report on the Geology of the East of Fife Coal-Field, with Map and Sections. By Mr DAVID LANDALE, Mining-Engineer, Wemyss, Fifeshire, 265
- XXIII. On Preserving Potatoes, and Raising them from Seed. By Sir G. S. MACKENZIE, Bart. 349
- XXIV. Memorandum communicated by Sir John Hall, of Dunglass, Bart., regarding Experiments in growing Rye-grass of different varieties. By Mr BUIST, Land-steward at Dunglass, . 354
- XXV. Account of the Mode of Planting practiced on the Property of the Merchant Maiden Hospital of Edinburgh, on the North-east Coast of Scotland. By Mr RODERICK GRAY, Pe-

	terhead. Communicated by ROBERT JOHN- STONE, Esq. Edinburgh,	355
XXVI.	On the <i>Pinus Austriaca</i> , or Black Fir of Aus- tria. By Mr CHARLES LAWSON, Seedsman to the Highland and Agricultural Society of Scotland,	359
XXVII.	On the Present State of the Upper Ward of Lanarkshire. By Mr DAVID WILSON, Wal- ston Manse,	361
XXVIII.	On the Extirpation of Ferns from Pasture Lands where the Plough cannot be used. By Mr M'TURK, Hastings Hall, Minnyhive,	371
XXIX.	On the best means of eradicating Ferns from Pastures. By the Hon. JAMES MURRAY,	376
XXX.	On the Settlement of Crofters—	
	1. By ALEXANDER THOMSON, Esq., Banchory House, Aberdeenshire,	379
	2. By COLIN MACKENZIE, Esq. of Kileo,	384
	3. By CHARLES FRASER, Esq. of Castle Fraser,	387
XXXI.	Report by Mr LAWSON on Larches raised by him from Seed imported from the Tyrol,	391
XXXII.	Mr MAULE'S Improved Chain-Plough,	392
XXXIII.	Improved Corn and Hay Cart. By ROBERT ROBERTSON, Farm-servant,	395
XXXIV.	Circular Coulter or Skiff adapted to the Com- mon Plough. By Mr BROOKE, Old Moor- house, Rotherham,	396
XXXV.	An Account of the principal Marble, Slate, Sandstone, and Greenstone Quarries in Scot- land. By Mr J. CARMICHAEL,	398
XXXVI.	On the Geology of Morayshire. By Mr JOHN MARTIN, Elgin,	417
XXXVII.	Account of the Method of Calcining Lime- stone in some of the Limestone Quarries in Scotland. By Mr JOHN WALLACE, Mans- field House, Cumnock, Ayrshire,	441

XXXVIII. Improvement of Waste Land,	456
Report of the Expense of reclaiming Land on the Farm of Wester Moy, in the parish of Contin and county of Ross, the property of J. A. STEWART MACKENZIE of Seaforth, Esq. M. P. By Dr JAMES WISHART of Dingwall.	
XXXIX. Improvement in the Mode of placing the Scutchers on the Drum of the Thrashing Machine,	456
XL. Machine for Compressing Peat-Moss. Invent- ed by the Right Hon. Lord WILLOUGHBY D'ERESBY,	459
XLI. On the Comparative Advantage of feeding Cattle in Close Byres and Open Hemmels. By JOHN BOSWELL, Esq. of Kingcausie, Kin- cardineshire,	461
XLII. On the Refuse of Herrings as Manure. By Mr RODERICK GRAY, Peterhead,	464
XLIII. On the Whin as a Fence. By WILLIAM BELL, Esq. of Hunthill, Roxburghshire,	466
XLIV. Description of a Conical and Grooved Pul- verizing Land-Roller. By J. STEWART HEP- BURN, Esq. of Colquhalzie,	471
XLV. Report on the Failure of the Potato Crop. By CHARLES FERGUSSON, Esq. younger of Kilkerran,	477
LIST OF MEMBERS,	513
INDEX,	567

LIST OF PREMIUMS FOR 1836.

1837.

PRIZE ESSAYS AND TRANSACTIONS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

PRELIMINARY NOTICE.

DURING the period which has elapsed since the publication of the Preliminary Notice prefixed to the Tenth Volume of the Society's Transactions, the Institution has continued steadily to prosecute its various measures for the encouragement of rural industry, and the advancement generally of the arts useful to the country ; and the progressive increase in the number of its members, has marked in the most gratifying manner the continued favour and confidence of the public. At the four last meetings of the Society, held within the period of two years, 205 new names have been added to the list of its members, the entire number being now 1935.

Amongst the subjects having more immediate relation to rural economy, a liberal premium has been offered for improving the construction of the Thrashing Machine, accompanied by an ample detail of the particular points on which information is wanted. Premjums have also been offered:—**For Experiments in the Feeding of Stock**, viz. the feeding of horses on raw and on prepared food ; on the employment of substances, other than the common produce of the farm, in the

feeding of live stock ; and for comparative experiments on the feeding of stock in close houses, and in sheds or hemmels ; for information founded on experiments on the comparative nutritive properties of the different varieties of the Turnip, and how far these are influenced by the nature of the soil and season ; for information as to the best mode of preserving Potatoes in good condition in their natural state for a period of not less than ten months from the time of their being taken up ; and for information on the nature and causes of the injury or disease which occasioned a partial failure in the Potato Crop during the two last seasons. On this last subject upwards of twenty communications were received, and the most important part of the information afforded by them will be given in the present volume. For the best descriptive account, founded on actual experiment, of the different Varieties of Potato adapted for culture, a premium was voted to Mr Matthew Howden of Lawhead, East Lothian, who furnished a very valuable report on 130 varieties (90 early and 40 late) raised by spade culture, and of which several were raised by the plough also ; the comparison shewing no advantage from the spade culture.

Among the other premiums are those :—For information on the Improvement of Flax Mills ; on the economical manufacture of Tiles for drains ; and for an Essay, generally, on the best mode of Tile-draining ; on the manufacture of Paper from the fibre of indigenous vegetables ; on the Insects injurious to vegetation ; on the management of Pasture Lands ; and for saving the seeds of the Italian Rye-grass, now partially introduced into the agriculture of the country.

Connected with the department of Woods and Plantations, several premiums on new subjects have also been offered. Of these may be noticed the premiums for an Essay on the pruning of Forest Trees ; for the introduction, in a state fit for germination, of Seeds of Forest Trees not yet in cultivation in this country, and which being natives of

such places as are in some measure analogous in climate to Scotland, may be expected to succeed in that country; and for the introduction from any part of the world of Cones containing seeds capable of germination, the produce of hardy species of the Fir tribe, which have been already introduced into Britain, but of which only a few plants have been raised.

The encouragement thus afforded to so great a variety of new objects, has not interfered with the Society's attention to those other classes of experiments and improvements for which it has been wont to offer rewards. Liberal premiums are continued to be offered under the general titles of Waste Lands, Crops and Culture, Improvement of the Products of Live Stock, and for encouraging Improvement in the comfort of Cottagers. In the class of Live Stock, in particular, premiums for the improvement of the breeds of Cattle, Horses, Sheep, and Swine, are, with the most beneficial effects, in operation in numerous districts throughout the country. The premiums for Horses have been considerably increased in amount, so as to give greater encouragement for bringing forward superior stallions, under conditions calculated to derive the greatest practical advantage from them. The Board of Trustees having discontinued its allowance for Tups, the Society has, besides giving its usual premiums at the general shows, supplied the deficiency by further premiums for the local competitions.

The Agricultural Meetings and General Shows of Live Stock continue to be attended with the most favourable results. In consequence of the liberal co-operation of the counties, principal burghs, and local associations, premiums are now given at these shows to an increasing variety and amount. Since the date of the introduction to the last volume, the meetings at Stirling and Aberdeen have been held, both distinguished in an eminent degree by the interest which they excited, and the success which attended them; and in

every part of the country the Society has had the gratification to remark a rapid and progressive improvement in every branch of Live Stock.

The next General Show takes place at Ayr, and for this meeting no less a sum than L. 576 is advertised in premiums. In consequence of the liberal contributions from this county, the Society has been enabled to offer additional premiums in almost every class of importance, as well as to devote a sum to the encouragement of the Woollen and Linen Manufactures of the district ; objects which must materially add to the interest and utility of the meeting.

It having been submitted to the Society whether it might not be expedient to intermit for a time these Annual Shows, with the view of availing itself of the interval for perfecting the system by collecting further information, and founding upon the experience already acquired, the necessary steps were taken by the Committee named by the Society, to ascertain the feelings and wishes of agriculturists on the subject. It was ascertained that the desire to continue these shows was universal, and the Committee, in the discharge of their duty, accordingly made a report on the principles on which they conceived these shows might be beneficially conducted. In this report, which has already been published in the Society's *Transactions*, the principal subjects discussed are,—the classification of breeds, the age at which animals should be exhibited, and the rules of competition. In regard to the last of these points, it was strongly recommended, and obtained the unanimous sanction of the General Meeting, that the shows should no longer be limited to the Live Stock of Scotland, but be thrown open to the whole kingdom.

This report having been adopted by the Society, the first show, the premiums for which have been fixed according to the principles therein recommended, is that which is to take place at Perth in 1836. At this meeting, in addition to the pecuniary premiums to the exhibitors, honorary premiums

are to be awarded in various classes to the breeders of the stock, as contradistinguished from the mere possessors. The show for the year 1837 has already been fixed to be held at Dumfries; and an application, most numerous and respectably signed, has been made on behalf of some of the western counties for a General Show to be held at Glasgow in 1838. These three last-mentioned places have already had general shows, and the anxiety evinced for their repetition promises favourably for the success of the competitions.

As connected with the improvement of the breed of Live Stock, is to be especially noticed the Veterinary School established under the patronage of the Society. This important establishment continues to be conducted by Mr Dick in a manner highly creditable to himself and advantageous to his numerous pupils. Upwards of sixty students attended during each of the two last sessions; and at the examinations following these courses, thirty-one were found qualified to practise, and received diplomas.

Of the new subjects to which the Society has been enabled to devote its attention, one has been the Mineral resources of the country, and the means of rendering them more known and available. In furtherance of this object, means were adopted for obtaining for the country the benefit of the materials collected at the public expense by Dr Macculloch, for a geological and mineralogical map of Scotland. In a country so varied in its surface, and everywhere abounding in mineral products, an accurate knowledge of the relations that exist in the stratification and position of the rocks of which it is composed, cannot fail to be of the highest use in leading to a better and more extended development of these resources; and the connection which this subject has with agriculture and general industry renders this department of knowledge of great practical utility. These considerations were duly appreciated by the Society, and a Committee was named to consider how the important objects could be best attained. The first step

taken by the Committee was to ascertain the intentions of Government in reference to the materials in question, because, if it contemplated the publication of a geological and mineralogical Map of Scotland, the object in view would be fulfilled without the necessity of any further measures on the part of the Society. A memorial was accordingly submitted by the Society to the Treasury on the subject, in which was represented the desire that existed in the country for the publication of a map of this description; and it was requested, that if Government had no intention of publishing the materials which had been collected by Dr MacCulloch, they might be placed at the disposal of the Society, with a view to their being rendered available to the public through its influence.

In the communications held with the Treasury there was found every disposition to attend to the Society's wishes, and to forward the important object in view. The Society had the satisfaction to find that, in consequence of their application, the Board of Ordnance has been instructed, and is now proceeding to have the map and memoir of Dr MacCulloch published by Arrowsmith, under its own superintendence. In carrying through this important object, the Society felt itself called upon to express its acknowledgments in a particular manner to Lord Greenock, the convener of the Committee, whose eminence as a geologist is well known, for the great trouble taken by him, and the zeal which he evinced by his attention to all the details of the measure.

An important step towards the attainment of a geological and mineralogical survey of Scotland, and an object otherwise of general utility and interest, is, that the nature of the rocks and other mineral produce of the country should be ascertained and made fully known, by means of a collection of a complete series of specimens, topographically arranged and correctly labelled. It was accordingly intimated in the advertisement of premiums, with the view to such a collec-

tion, that it would be esteemed not only a favour to the Society, but a public benefit, if the proprietors of estates, or the owners or lessees of quarries and mines worked in Scotland, would cause specimens of the different rocks, ores, and other minerals of their respective districts, to be transmitted to the Society's museum in Edinburgh. Numerous specimens have already been received, and there is reason to believe that an interesting collection will very soon be formed. With this expectation, the Directors have authorized suitable arrangements to be made in the Society's house, for the classification and display of the specimens.

In further prosecution of these objects, premiums have been offered for Geological Surveys of the different counties or districts in Scotland, and information regarding the principal Coal-fields of the country, and the particular works now in operation. On this subject, an important paper, by Mr Landale, of Wemyss Colliery, on a portion of the Fife Coal Field, was received last year, and a description of an under-dip coal work in the same district, was transmitted by the same individual. Both papers were read with much approbation at the meeting of the British Association, and have since been published in the Society's Transactions. The gold medal was voted to Mr Landale, and the premiums are continued.

It is gratifying to the Society that the efforts which they are making to advance mineralogical and geological inquiry in Scotland, are duly appreciated. The geological section of the British Association for the Advancement of Science was pleased to pass the following resolution, which was officially communicated by the Secretary of the Association:—"On the motion of R. J. Murchison, Esq., seconded by Professor Sedgwick, it was resolved,—That the thanks of the British Association for the Advancement of Science be given to the Highland and Agricultural Society of Scotland, for their liberal and zealous endeavours to promote inquiries into the geology of Scotland." And it may be here observed, that on

occasion of the visit to Scotland of the distinguished Association now noticed, the Society considered it a mark of respect due to that eminent body, to tender the use of its public rooms for such of the meetings of the members as they might accommodate ;—an offer which was accepted by the Association.

As connected with the important object of the introduction of new plants into the agriculture of the country, it may be noticed that the Honourable W. Leslie Melville has, through Sir John S. Forbes, the Society's Treasurer, presented to the Society a very interesting collection of seeds from India, amounting to above thirty kinds, and including those of forest and fruit trees, shrubs, grain, and grasses. Portions of these seeds were delivered by the Society to Dr Graham, for the Royal Botanic Garden ; to Dr Neill, for the Experimental Garden of the Caledonian Horticultural Society ; and to Mr Lawson, the Society's nursery and seedsman. In consequence of this distribution, every attention will be paid to their cultivation, and the Society will be enabled to report the result of the trials. The best thanks of the Directors were voted to the Honourable Mr Leslie Melville for his attention.

The Society voted its gold medal to Messrs Drummond of Stirling, for the spirited manner in which they had originated an establishment for the exhibition of seeds, plants, and other agricultural objects. The example afforded by them has been followed in other parts of the country, particularly at Edinburgh by Mr Lawson, and at Perth by Mr Turnbull. To give encouragement to this species of exhibition, so interesting and beneficial to agriculturists, the Society transferred, for a limited time, to Mr Lawson's collection, the series of models of machines and implements in use in the practical agriculture of Scotland, belonging to the Society's museum.

At the last Anniversary General Meeting, the Duke of

Buccleuch completed the period limited by the constitution of the Society for holding the office of President. The admirable manner in which his Grace had discharged the duties of that office was well known, not only to the members, but also to the country at large, and the Board of Directors had felt it a duty to record their feelings by a resolution, which had been communicated to the Noble Duke, and which was unanimously adopted by the Society. This resolution was expressed in the following terms:—

“Resolved, that in reference to the retirement of his Grace the Duke of Buccleuch and Queensberry from the situation of President of the Society, which he has now held for the period prescribed by its constitution, the Directors are unwilling to allow this opportunity to pass without bearing testimony to the very zealous and eminently efficient services which his Grace has rendered to the Society in the discharge of the important duties which devolved upon him in that capacity; and they beg to tender to his Grace the thanks of the Directors, as the best acknowledgment which that body has it in its power to make, of the sense which they entertain of the excellent spirit with which he undertook these public duties, and of his care and perseverance in pursuing them.”

There will be found appended to this notice the Supplementary Charter by which the Society is of new incorporated into a body politic, by the name, style, and title of “THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.” The Society, although its efforts were originally confined to the Highlands, has for a great number of years been practically the great Agricultural Society of Scotland; and the Directors, as well as the members generally, had for a considerable time been impressed with the expediency of its bearing something of that character in name, as well as in effect. A Committee having been appointed to prepare Regulations for a new Charter, in order to remedy several defects in the

original one, an opportunity was afforded of considering as to the adoption of a new or extended name for the Society. The Committee thought it was hardly open to adopt an entirely new name; they were unwilling to drop that under which the Society had so eminently prospered, and had published its Transactions, and other works of great interest and value; and they finally came to the resolution to retain essentially a name with which the Society's publications and proceedings are identified, and to introduce only the necessary words explanatory of its present objects. Accordingly, in adopting the name under which it has been reincorporated, the Society considered the extended designation as sufficient for the object desired. A special General Meeting was held on the 12th of May 1834, to consider the Report of the Committee, and the several Regulations and Bye-Laws proposed, as they had been adjusted by the Committee and Directors, and revised by eminent counsel, when the same were unanimously approved.

A petition to the King was thereupon presented, subscribed by the Duke of Buccleuch and Queensberry, the President, and by the Dukes of Gordon and Sutherland, the Marquis of Tweeddale, and the Earl of Rosebery, the four Vice-Presidents in office. His Majesty's Secretary of State, the Lord Advocate, and the other authorities, gave the matter immediate attention, and forwarded the petition through all its stages with the utmost despatch; in consequence of which, the Charter was laid on the table of the Society at its usual Half-yearly General Meeting in July last. At this meeting, on the motion of Lord Greenock, seconded by Sir John Hope, Bart., the Society assumed the name, and placed itself under the government of the rules and regulations of the new charter, which, with the relative bye-laws, was ordered to be printed for the use of the members.

It having been resolved to present an Address to the

King, on the occasion of receiving the new charter, one was accordingly prepared and transmitted to the Duke of Buccleuch, to be laid before his Majesty. This Address was in the following terms :—

“ To the King.

“ Most Gracious Sovereign,

“ We, your Majesty’s faithful subjects, the Highland and Agricultural Society of Scotland, beg leave most gratefully to express to your Majesty the deep sense we entertain of your Majesty’s favour in granting to us, by your Royal warrant, a new and supplementary charter, confirming and extending those corporate rights which we have hitherto enjoyed through the favour of the Crown.

“ Devoted by the purposes of our Institution to the improvement of our native country, we receive this mark of your Royal favour as the earnest of your Majesty’s paternal solicitude to promote the prosperity of the country as founded on the progress of industry and the cultivation of the useful arts. And it is grateful to us to call to our recollection, that it has been under the beneficial sway of your Illustrious House, that the industry of this country has been the most favoured,—that agriculture, commerce, and all the arts, have been the most successfully cultivated,—and that the greatest advances have been made towards that solid strength of the State which is founded on the numbers, enterprise, and opulence of the people.

“ Feeling the blessings we have enjoyed under a true liberty, maintained and tempered by the supremacy of the law, we beg to express our ardent attachment to those institutions of the State, under which the nation has so greatly prospered, our dutiful devotion to your Royal Person and Family, and our unabating confidence that your Majesty, in the discharge of the high functions of your Royal office, will

prove alike the friend of the liberties of the people, and the guardian of the rights of the Throne.

“ Sealed with the seal of the Society, and signed by his Grace the Duke of Buccleuch and Queensbery, the President, by desire of the Society in a General Meeting assembled.

(Signed) “BUCCLEUCH AND QUEENSBERY, *P.*

“EDINBURGH, 7th July 1834.”

In consequence of the Duke of Buccleuch and Queensbery having left London, the charge of presenting this Address to the King devolved on the Marquis of Tweeddale. His Lordship delivered to the Society certain documents connected with this presentation, and noticed how highly his Majesty had spoken regarding the Society, how kind his Lordship's reception had been on the occasion, and how cordially his Majesty had expressed his affection towards this part of his dominions ; his Majesty stating, that he had often heard his brother mention the great pleasure which he felt in recurring to his reception in Scotland, and the deep interest which he felt in all its institutions, and amongst these, in an especial degree, the Highland Society of Scotland.

HIGHLAND SOCIETY HALL, EDINBURGH,
11th May 1835.

ROYAL WARRANT FOR A NEW AND SUPPLEMENTARY CHARTER TO THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

WILLIAM R.

OUR SOVEREIGN LORD, considering that, on an humble Petition presented to His Majesty King GEORGE III, His Majesty's Royal Father, of gracious memory, by and on behalf of JOHN DUKE of ARGYLL, then President, and CHARLES EARL of ABOYNE, The Honourable HENRY ERSKINE, Dean of the Faculty of Advocates, Sir WILLIAM FORBES, of Pitsligo, Baronet, and ROBERT DUNDAS, Esq. the Younger of Arniston, His Majesty's Solicitor-General for Scotland, all now deceased, then Vice-Presidents of the Society, called the *Highland Society at Edinburgh*, setting forth, That in the year 1784, the Petitioners and other Persons had formed themselves into a Society by the name or title of *The Highland Society at Edinburgh*, their objects being to inquire into the state of the Highlands and Islands of Scotland, and of the Inhabitants, and into the means of the Improvement of that part of the country, by the establishment of towns, villages, and harbours, facilitating the communication through the different parts of the Highlands by roads and bridges, extending and promoting the fisheries, encouraging agriculture, and introducing useful manufactures, and by thus uniting the exertions of the proprietors of land and others, to call the attention of the public to the promotion of such beneficial objects, His Majesty's said Royal Father did, by Charter or Letters Patent, bearing date the 17th of May in the year 1787, constitute, erect, and incorporate the said Petitioners, and the other persons who were then Members of the said Society, and such other persons as should thereafter be admitted Members thereof, into one body politic and

14 *Royal Warrant for a Supplementary Charter to the*

corporate, or legal incorporation, by the name and title of **THE HIGHLAND SOCIETY OF SCOTLAND AT EDINBURGH**, with the powers, and under the regulations particularly narrated in the said Charter or Letters Patent.

AND OUR SOVEREIGN LORD further considering, That, in an humble Petition presented to His Majesty by **WALTER FRANCIS DUKE of BUCCLEUCH and QUEENSBERRY**, President, **GEORGE DUKE of GORDON**, **GEORGE GRANVILLE DUKE of SUTHERLAND**, **GEORGE MARQUIS of TWEEDDALE**, and **ARCHIBALD JOHN EARL of ROSEBERRY**, Vice-Presidents, in name and on behalf of themselves, and of the whole other Members of **THE HIGHLAND SOCIETY OF SCOTLAND AT EDINBURGH**, incorporated as aforesaid, it is set forth, 'That the said Society, since its erection into a body corporate, had continued to promote the laudable and patriotic purposes of its institution, which had been productive of great benefit to the country; that from the general approbation with which its exertions had been viewed by the public, the Society had received a large accession of Members, and that it now consisted of about 1900 Members, including a very large proportion of the noblemen and gentlemen of rank, property, and professional eminence in Scotland; that whilst the Society had continued to devote a great share of its attention to the Highlands of Scotland, it had of late years been enabled, from the general support which it had received, gradually to extend the sphere of its usefulness, by giving considerable sums annually in premiums for the purpose of improving agriculture, encouraging industry, and rewarding useful inventions in the arts therewith connected, all over Scotland; and also representing to His Majesty, that the Society having applied its funds in a way which experience had shewn to be highly advantageous, is fully satisfied that the continuance of its attention to the improvement of agriculture and the different branches of rural industry, and the arts therewith connected,

all over Scotland, as well as to such of the original objects of the institution as may still be beneficially advanced by the Society's exertions, would be eminently beneficial to that part of the United Kingdom, as well as to the nation at large : And further setting forth, That this extension of the purposes of the Institution had been approved of and acted upon by the Society for several years, and that certain alterations in the rules and regulations of the Society, and a variation or extension in their designation or title had been specially approved of at and by a General Meeting of the Society, held at Edinburgh on the 12th day of May 1834,—THEREFORE PRAYING that His Majesty would be graciously pleased to grant a New or Supplementary Royal Charter or Letters-Patent, under the Seal appointed by the Treaty of Union to be kept and used in Scotland in place of the Great Seal formerly used there, of new nominating, constituting, and appointing the Petitioners and the other Members of the Society, and such other persons as shall be afterwards admitted Members thereof, agreeably to the rules of the Society, into one body politic and corporate, or legal incorporation, by the name and title of "THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND," and under the regulations mentioned in the said Petition : AND HIS MAJESTY being satisfied that the design of the Petitioners is laudable, and that the patriotic purposes of the said Society eminently deserve encouragement, does therefore ordain a Charter or Letters-Patent, to be passed and expedite under the Seal appointed by the Treaty of Union to be kept and used in Scotland in place of the Great Seal formerly used there, constituting, and of new erecting and incorporating, as His Majesty, by his prerogative-royal, and of his special grace, for himself and his Royal successors, hereby of new constitutes, erects, and incorporates the said Petitioners, and the whole other persons who now are Members of the said Society, and such persons as shall hereafter be admitted Members thereof, agreeably to the rules of the said

16 *Royal Warrant for a Supplementary Charter to the*

Society, into one body politic and corporate, or legal incorporation for ever, by the name and style of **THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND**, which is in future to be the name of the said Society instead of “The Highland Society of Scotland at Edinburgh,” which they at present use, and as such and by such name and title hereby granted, to have perpetual endurance and succession ; with power to the said Society, under the aforesaid name and title, to purchase, take, hold, receive, enjoy, possess, and retain for the uses and purposes of the Society, lands, tenements, or hereditaments, or any estate or interest therein, not exceeding the sum of **L. 2000** Sterling of yearly rent or value, after deducting feu-duties, land-tax, ministers’ stipend, and other public burdens ; and to sell, exchange, or dispose of the same ; as also to hold, take, receive, enjoy, possess, and retain for the uses and purposes of the Society, all such sum and sums of money, annualrents, goods, and other personal property, as have already been paid, given, received, devised, or bequeathed, or shall at any time hereafter be paid, given, received, devised, or bequeathed, for the uses and purposes of the said Society, under the original or the former corporate name, or the name, style, and title hereby granted ; and with full powers also to the said Society to lend out the money, funds, and effects, already acquired and received, or to be acquired and received, on such security, heritable or personal, in Scotland, or in the stock of any of the incorporated banks, or in the public funds of the United Kingdom, as may be determined and approved of in manner after mentioned ; declaring that all charters, dispositions, heritable securities, and all other deeds affecting property, heritable or personal, to be granted to or by the said Society, shall be taken to and granted by the said Society in the corporate name and title hereby granted,—that is, to “The Highland and Agricultural Society of Scotland,” without specifying the names of the Pre-

sident, or any of the office-bearers, or constituent members of the said Society ; And that all charters, dispositions, or other deeds of conveyance, contracts, discharges, renunciations, acquittances, or other deeds whatever, touching the real estate or the capital of the said Society, granted by the said Society, shall be subscribed by any three of the Ordinary Directors, along with the Treasurer, or, in his absence, along with the Honorary Secretary for the time being, and shall be executed at one or other of the stated General Meetings of the Society, or at any meeting of Directors specially summoned for that purpose, and that all such deeds or instruments shall be equally valid and effectual as if the same had been signed by the whole Members or Directors of the said Society : And his Majesty, by these presents, for himself, his heirs, and successors, declares and ordains that all such lands or other heritages, and also all such sum or sums of money, stocks, funds, bonds, heritable or personal, mortgages, or other securities for money whatsoever, as shall at the date of this Charter be held, or shall stand secured or vested for the interest or behoof of the said Society under the former corporate name, or in the name of any office-bearer or office-bearers, or other persons, may and shall continue invested for the purposes of the said Society as now of new incorporated, until the same respectively can be conveniently called up and reinvested, or transferred, or assigned, and duly vested in the said Society, by and agreeably to the name, style, and title hereby granted ; and that all deeds and other instruments necessary for the conveying, assigning, discharging, and reinvesting the same, shall be subscribed and executed in the manner and according to the form above prescribed : And all actions or proceedings at law at the instance of the Society, may be brought and maintained in the name of the said Honorary Secretary in his official capacity, and that the death, resignation, or removal of such Secretary shall not abate or prejudice any such actions or proceedings at law, but the

18 *Royal Warrant for a Supplementary Charter to the*

same may be continued, prosecuted, and carried on in the name of any other Honorary Secretary for the time being, in the same manner as if he had been an original party thereto ; And with power likewise to have and use a common seal, and to change, alter, break, and make new the same from time to time as to the said Society shall seem expedient ; and otherwise, and in all other things, to act, and do, and proceed in such manner as the law permits, and as is usual in the case of persons incorporated, and with all the privileges incident to such incorporations : And further approving, as his Majesty hereby approves, of the following Regulations made by the said Society ; That is to say, *First*, the said Society shall consist of two classes, Ordinary, and Honorary or Corresponding Members. The number of the Honorary or Corresponding Members resident in the United Kingdom of Great Britain and Ireland shall not exceed twenty, but with power to the Society to elect as Honorary Associates persons resident abroad, not subjects of his Majesty, who may have been benefactors to the Society, or who are distinguished for their skill in art or science, provided that the number of such foreign associates shall not exceed twenty. *Second*, The mode of election of Members, Ordinary or Honorary, shall be by ballot, at one or other of the stated general meetings, and in the manner to be prescribed by any regulation or bye-law to be made thereanent, as hereinafter directed. *Third*, The Society shall hold two general meetings in each year, one upon the second Tuesday in January, and another upon any lawful day of the months of June or July, which the Directors of the Society shall fix annually at any of their ordinary meetings in May or June, and make known by advertisement in any two or more of the Edinburgh newspapers, at least eight days before such meeting : And it shall be in the power of the Directors to call occasional general meetings, previous intimation of such general meetings, and the purpose thereof, being made by advertisement in any two or more of the said newspapers, at least ten days before such meeting. At the said general meet-

ings of the Society, twenty shall be a quorum ; and the President, or, in his absence, one of the Vice-Presidents, or, in the absence of the Vice-Presidents, any Member who has held the office of President or Vice-President ; and, in the absence of these, the senior Director present, shall preside ; and all questions before general meetings shall be decided by a majority of votes of the Members present. *Fourth,* The Society shall annually, at the general meeting in January, choose, out of the Ordinary Members, a President, four Vice-Presidents, a Treasurer, and an Honorary Secretary. And the Society shall also annually, at the said General Meeting in January, choose out of their Ordinary Members, who are usually resident in Edinburgh or in its immediate vicinity, a Board of Thirty Directors, of whom at least Seven shall be newly elected ; and also Ten Extraordinary Directors, who may be only occasionally resident in Edinburgh ; which several President, Vice-Presidents, Directors, Ordinary and Extraordinary, Treasurer and Honorary Secretary, shall manage and direct the ordinary business of the Society in all matters, in compliance with the constitution, bye-laws, and regulations of the Institution :—Declaring that, in all meetings of the Directors, seven shall be a quorum ; that the President, senior Vice-President, or, in their absence, the senior Ordinary Director present, shall be Chairman of the meeting ; and that the Preses or Chairman of all meetings of the Directors, and of all general meetings of the Society or Incorporation as aforesaid, shall have a deliberative vote ; and, in case of an equality, also a casting vote. *Fifth,* The Directors shall annually appoint a Secretary for conducting the general business of the Society, and also any other officers or servants they may find necessary to employ ; and the Directors shall fix the salaries or allowances to be paid to such Secretary and other officers or servants : But the said appointment of a Secretary and others officers or servants receiving salaries, and the salaries or allowances to be paid to them, shall always be subject to the approbation of the Society at

20 *Royal Warrant for a Supplementary Charter to the*

their General Meeting in January ; and the Directors shall also have the power to remove the Secretary and other officers or servants appointed by them : And those who at present act as President, Vice-Presidents, Directors, and Officers of the said Society, shall continue, and have the power of officiating as such until the next General Meeting of the Society, on the second Tuesday of January next ensuing, when the President, Vice-Presidents, and other necessary officers, shall be elected and approved of for the then next ensuing year. *Sixth,* The Ordinary Members of the Society shall pay upon admission, and afterwards annually, towards the general fund of the Society, such sum or sums as the Society may from time to time fix and declare, by any regulation or bye-law, in manner herein after directed ; with power to the said members to redeem the annual contribution, by a payment in one sum as the purchase of a Life Subscription, at such rate as the said Society shall from time to time authorize and appoint. The Honorary or Corresponding Members and Foreign Associates, shall not be subject to any annual contribution or other payment. Each Ordinary Member of the Society shall pay his annual contribution for the preceding year, at or before the general meeting in January, or otherwise he shall have no vote. Any person elected an Ordinary Member of the Society, who shall not have objected to his election, on the same being intimated to him by the Secretary, shall not be entitled to resign or withdraw his name as a member of the Society, unless he shall have paid up his life subscription, or shall have previously settled and paid, in annual contributions, a sum equal to that fixed by the Society at the time of his election, to be paid by members as the purchase of a life subscription, in lieu and in redemption of the annual payments ; And the Directors shall have power to cause actions or proceedings at law to be instituted against members in arrear of their annual payments, for recovery of such arrears ; and it shall not form a bar or valid defence against such actions or

proceedings, that the member has tendered his resignation : And it shall be in the power of the Society to expel any member, for any cause which shall appear to a general meeting to require that proceeding ; and all such persons shall thereupon cease to be members, or to have any right or interest in the Society or its concerns accordingly. *Seventh*, The annual payments by the Ordinary Members of the Society, or sums paid in lieu thereof as contributions for life, shall be paid to the Treasurer, or to any collector to be named by him, such collector being bound to find security for his intrusions, to the satisfaction of the Directors ; and he shall receive such remuneration as the Directors shall from time to time fix and determine : And all sums received by the Treasurer or Collector, shall be lodged with the Royal Bank of Scotland, or with such other Bank or Banking Company as the Directors shall appoint ; and neither the Treasurer nor the Collector shall at any time retain any balance of the funds in his or their hands greater than L. 50 Sterling. *Eighth*, The funds hitherto acquired, and now belonging to the Society, shall form a part of its capital stock ; and all the moneys to be hereafter received as life subscriptions or the price or redemption of the annual contributions of members, shall, either in whole, or to such amount as the Society shall at any time direct and appoint, be added to the capital,—the interest, dividends, or annual produce of which only shall be applicable to the general purposes of the Society ; and any donations or bequests that may be made to the Society, which shall not be otherwise devised, shall also form a part of, and be added to the capital, and may be employed in the purchase of lands, houses, or other heritable subjects, under the qualifications and restrictions above mentioned, or be invested upon proper security, heritable or personal, in Scotland, or in bank stock, or in the public funds, by the authority of the Directors, subject to the approbation of a general meeting : And no part of the capital, either already acquired or

22 *Royal Warrant for a Supplementary Charter to the*

to be so formed, shall be afterwards applied, except by authority of a general meeting, and upon intimation of the intended application being made at two meetings of the Board of Directors, previous to such general meeting ; but the Directors, with the approbation of the Society, shall at all times have power to uplift the said capital, or any part thereof, for the purpose of reinvesting the same on any other security which may appear to them preferable, or in the purchase of lands or other heritable property, to the annual value before specified ; but no part of the capital shall be lent, originally, or upon reinvestment, to any person or persons holding an official situation or appointment under the Society at the time the same is to be lent or reinvested. *Ninth*, The Society, at its general meetings, shall have power to apply the revenues of the Society for the purposes of the Institution, and to put at the disposal of the Directors annually certain sums, to be applied by them in such manner as may appear to them to be most conducive to its interests, but with and under the provisions before made as to the capital stock. *Tenth*, All orders or warrants for application of money, shall express the purpose of such application, and shall be signed by the Preses of the general meeting, or of the Meeting of Directors at which they may be authorized; and shall also be countersigned by the Treasurer, or, in his absence, by the Honorary Secretary. The Treasurer shall annually make out a detailed account of the income and expenditure of the Society, and of the state of the Society's funds; and the Directors shall annually, at their meeting immediately preceding the General Meeting of the Society in January, have the accounts of the Treasurer audited, and a state of the funds of the Society made up ; and the Treasurer shall produce the said accounts and state of the funds, at the General Meeting of the Society in January, and submit an abstract or abbreviated view thereof, for the consideration of the Society ; The accounts shall also be produced at every meeting of the

Board of Directors for their inspection, all conformably to the usage of the Society. And his Majesty wills and appoints, that the said regulations be duly observed, giving and granting nevertheless, as his Majesty, for himself and his royal successors, of new gives and grants to the Members of the said incorporated Society, and their successors, at their general meetings, assembled from time to time, full power to alter or annul any of the bye-laws, rules or regulations at present in observance, and to make such other bye-laws, rules, regulations or orders, as they, or the majority of them present at such meetings, shall judge proper and necessary, for the better government and direction of the said Incorporation; and afterwards to alter or annul the said regulations herein before recited, as well as the bye-laws, rules, regulations, and orders, to be made in future, or any of them, as the Members of the said Incorporation so assembled, or the major part of them present at such general meeting, shall deem proper and requisite: And his Majesty wills and directs, that all the bye-laws, rules, regulations, and orders, made as aforesaid, shall, until altered, be duly observed and kept, provided that the same are noways contrary to the law of the realm, and to the general purport and meaning of his Majesty's said Charter and Letters-Patent; and provided likewise, that such bye-laws, rules, regulations, and orders, or any of them, and every alteration thereof, shall be notified at two meetings of the Board of Directors previous to the general meeting of the said Incorporation at which they are proposed to be made, declared, or altered; and shall also be confirmed in and by the next general meeting of the said Incorporation, held and kept after they shall have been respectively made as aforesaid: And his Majesty does, for himself and his heirs and successors, declare, that the said Charter or Letters-Patent, shall be in and by all things valid and effectual in law, according to the true intent and meaning thereof, and shall be taken, construed, and adjudged, in the manner most fa-

vourable and beneficial for the best advantage of the said Incorporation, notwithstanding any misrecital, defect, uncertainty, or imperfection in the same: And his Majesty doth further will and command, that this Charter do pass the Seal appointed by the Treaty of Union to be kept and used in Scotland in place of the Great Seal thereof formerly used there, without passing any other seal or register: For doing whereof, these presents shall be to the Director of his Majesty's Chancery in Scotland, and to the Keeper of the said Seal, and their Deputies, a sufficient warrant. Given at His Majesty's Court of St James's, the 18th day of June 1834, in the fourth year of His Majesty's reign.

By His Majesty's Command,

MELBORNE.

Bye-laws passed referable to the Provisions of the Charter.

That the Ordinary Members of the Society shall pay at admission, and afterwards annually, in advance, towards the general fund of the said Society, the sum of L. 1 : 3 : 6, with the option and power of redeeming the same by payment of Twelve Guineas, as the purchase of a Life Subscription; and which Life Subscription may be so purchased under deduction of any annual payments that the Member may have previously made, with this limitation, that at no time shall a Member have the power of redeeming the annual payments for a less sum than L. 7, 1s., or six years' annual contributions.

The mode of Election of Members of the Society shall be by ballot, at either of the said stated general meetings,—at which at least twenty Members must be present. The names of all Candidates for admission as Members shall be lodged with the Secretary at least ten days before the general meeting at which they are to be proposed; and such persons whose names shall have been so lodged, as shall be approved of by

four parts in five of the Members balloting, shall be declared to be duly elected. And Honorary or Corresponding Members or Associates shall not be declared duly elected, unless three-fourths of the Members present at the general meeting at which they are proposed shall have voted for the same.

The Society, when a ballot for Ordinary Members is to commence, and after the names and designations of the Candidates have been read over, shall have the power, by the unanimous consent of the Members present, to dispense with the form of individual ballot, provided it shall appear to the satisfaction of the meeting that the names of the whole Candidates on the list have been read and approved of in and by the meeting of the Directors immediately preceding such general meeting; and, in this case, the election shall be deemed and held to have been made by ballot, according to the intent and meaning of the Charter.

The President shall not continue in office for more than four consecutive years. The two Senior Vice-Presidents, and the seven Ordinary Directors who were senior on the List at the preceding election, shall be annually changed, and such number of the Extraordinary Directors, not being fewer than Two nor more than Five, as the Society may determine, shall also go out of office annually, all in manner and conformable to the regulations and usage of the said Society; and the President, Vice-Presidents, and Directors, Ordinary and Extraordinary, who so vacate office, shall not be eligible to be re-elected in the same capacity for at least one year. Any Ordinary Director who shall have retired to the country for a year, or shall be resident in town and shall not have attended a meeting of the Board of Directors during the same period, unless prevented by bad health, shall be held to have vacated his seat in the Direction.

The Board of Directors shall meet on the first Friday of each month during the sittings of the Court of Session, and occasionally, as business may require, upon any other lawful day, or at any other season, upon intimation by the Secretary,

The Directors shall keep a record of their proceedings, to be laid before the general meetings for their consideration and direction. All Members of the Society, though not in the Direction, may attend the meetings of the Directors and deliver their opinion, but they shall have no vote. The President and Vice-Presidents, Treasurer and Honorary Secretary, shall be entitled to vote at meetings of Directors.

The hour of assembly for General Meetings shall be One o'clock afternoon, and the ballot shall commence as soon after that hour as twenty Members have met.

Ladies who are Members of the Society are authorized to name a proxy, by letter or otherwise, to attend and vote for them, such Proxy being always a Member of the Society, and their vote by such proxy shall be received and reckoned as if they were personally present.

The Society shall, at the general meeting in January yearly, elect a professional Accountant, as Auditor of the Society's Accounts, who shall accordingly audit the Treasurer and Collector's accounts annually, previous to the same being submitted to the general meeting in January.

Upon considering the State of the Funds submitted by the Treasurer at the General Meeting in January, in pursuance of the Charter, and the probable free income of the Society for the year then current from the said General Meeting, the Society shall vote a sum to be applied in such manner as the Directors may think most beneficial for promoting the purpose of the institution, and also such additional sum as may appear necessary for defraying the ordinary expenditure incurred in managing the business of the Society.

The Secretary, who receives a salary for his trouble, shall write the minutes and proceedings, and carry on the ordinary correspondence of the Society, and superintend the keeping of the records, papers, and correspondence. The said records, papers, and correspondence, shall be at all times subject to the inspection of the Board of Directors, or any member thereof.

ESSAYS ON THE PARTIAL FAILURE OF THE POTATO CROP
OF 1833.

[In consequence of the partial failure which took place in the Potato Crop of 1833, the Society in the following year offered a premium for the best Essay on the nature and causes of the injury or disease, and on the best means of preventing or palliating it in future. Candidates were requested to direct their attention especially to the probable existence of insects in the sets or tubers, and to examine the state of the growing plants with reference to that supposed cause of the disease. Upwards of twenty essays were received, to the authors of one of which, Messrs Macdonald, Huntly, the premium was awarded. At the same time the Silver Medal was voted to Messrs Malher and Winder, Liverpool, for an essay which was considered next in merit.]

ESSAY I.—*By Messrs GEORGE and JAMES MACDONALD,
Huntly.*

THE Highland Society of Scotland having requested communications from agriculturists and others regarding the disease which appeared in the potato crop of last year, we beg leave to offer the following remarks on the subject.

We may state at once that we attribute the disease to the *heating of the seed*, and to that cause *alone*. In 1832, being the year previous to that in which the first complaints were made, we planted about eleven acres of potatoes, and were surprised to find that from three to four of them turned out a total failure. The common symptoms which have been so frequently mentioned were observed throughout, viz. rotten seed, and great numbers of small worms. Last year we laid down about fourteen acres, nearly one half of which, about seven acres, failed in the same manner as they had done the

year before. We therefore began in good earnest to examine into the cause, and, on observing the field, we noticed that there were generally five furrows or drills next to each other which had shared the same fate, being either healthy, or partially or wholly destroyed. Sometimes half the length had a healthy aspect, while the other half length of these five drills presented a complete blank. From these observations we were led to recollect, that in planting there had been five persons employed, one to each drill, and we could not resist the conclusion, that the failure or disease was in the seed. On digging up the seeds, we found them dead, rotten, and full of worms, with a few exceptions, in which, although the disease had spread to a certain extent, it had not reached the eye of the potato, and from these seeds, partially diseased, feeble stems were sent forth, which, however, the seed had been unable to nourish until they could strike roots into the ground and rise to the surface. These stems, therefore, as by a dying effort, produced *small potatoes on their tops*, from which leaves began to point out after the seed potatoes had ceased to afford nourishment to the original shoots. These, however, never came to any thing; and we mention this only as a singular circumstance which no writer, in so far as we know, has noticed.

We found no difference in the features of the disease in that part of the field where the manure was new, nor was any perceptible change produced by varieties of soil. The failure was complete in many parts where the manure was old, and the land, in former years, had produced fair average crops as far back as recollection goes. We ought also to mention that there was no part of the field wet or cold, circumstances which have occasioned partial failure in former seasons, although not to an extent deserving of general notice.

We had adopted the common plan of cutting seed potatoes two or three weeks before planting. They were generally stowed in heaps in a shed, or by the side of the pit, and it is

our settled conviction, that *in these heaps* the seed was damaged by *heating*. In April and May of both years the heat of the sun was great, while we had frequent warm showers, and these causes, combining with the exudation of the natural sap from the cuts, produced heating in the seed-heaps to such an extent as, for the most part, to destroy the vegetative principle.

When we discovered the failure, we began with as little delay as possible to fill up the blanks by planting a second time about the middle of June, dibbling in fresh seeds. Being obliged to take all the different kinds that came to hand, we had white and black kidneys, round red, speckled, and Irish white, all which came up, and, notwithstanding the advanced period, produced from a half to two-thirds of an average crop.

Profiting by our experience, and having, as we believed, ascertained the cause of failure, we cut the seed this season (1834) on the same day in which it was put into the ground, or on the night before, and, in consequence, we have scarcely one blank visible over a field of fourteen acres, that is, no *deficiency whatever*, except what may have arisen from the seed having been extracted by the crows, or a set inadvertently cut without an eye.

Now, with reference to the failure of our crops of 1832 and 1833, we have already stated that the seed when cut was laid up in heaps. From these heaps the five persons employed filled their baskets, at one time taking from the *outside*, and at another from the *centre* of the heap. The seed taken from the outside, having undergone little or no heating, produced the healthier plants, while those from the centre, having been entirely destroyed, produced nothing; and thus we account for the uniform appearance of five, ten, fifteen, or twenty drills (always fives), whether healthy, weakly, or a blank.

Besides, it is very common, on opening a potato-pit in spring, to find that all or the greater part of the potatoes have

germinated, and whenever this is the case, it proves that the potatoes are in a healthy state. Such was the condition of ours last year; they were growing before they were cut; they died afterwards; and we are of opinion, that on no principle but that of heating could such a fact be accounted for. Moreover, our *second* planting proved successful; but had the potatoes themselves been diseased before cutting, what good could have resulted? The fact that second planting has succeeded, proves that there is no inherent disease in this root. One fact more may be mentioned here:—In the spring of last year, our planters, while waiting on one occasion the spreading of the manure, were ordered to occupy the short time they were unemployed in cutting some additional seed, which they afterwards put into their baskets, and carried directly to the field. The spot in which this seed was planted was regularly filled up with plants, while all around the failure was decided. We think these statements satisfactorily prove that heating was the sole cause of the failure of our potato crop in both years.

We shall now endeavour to apply this principle to the disease as it has appeared in various forms throughout the kingdom, first offering a few general remarks. There are various ways in which potatoes may be heated so as to destroy their vegetative principle:—too large quantities may be stored in pits; they may be pitted when wet from rain; or they may be stowed under rain in the hold of a vessel for exportation; under all which circumstances heating will certainly be produced to a greater or less extent. Whole potatoes, however, are in much less danger of being heated than those which are cut, they being defended by the skin, and even when mixed with cut potatoes will often escape when the latter are destroyed, of which we had repeated proofs last year. Potatoes, too small to be cut, were thrown into the seed heap, which was afterwards damaged, and, on examining the solitary stems which here and there sprung up in the blanks, we often found

that the seed was a whole potato. On this ground we account for the success attending the planting of whole potatoes, as recommended by various writers, but we do not consider the plan a *specific* against the disease, because whole potatoes, although not so much exposed as cut ones, may yet be heated in the various ways above mentioned.

It being unnecessary again to refer to those symptoms of disease which we have already noticed, and which have been universally remarked throughout the kingdom where the potato crop has failed, we now come to the fact that great numbers of small worms have been observed in the rotten seed. Various theories have been advanced on this subject, most of which regard the worm as the *cause* of the disease, and of the failure of the crop. But from this opinion we dissent for the reasons mentioned below, and we are of opinion that the principle which we have advanced accounts more naturally for their presence than any other. We remark, *1st*, That we have never met with these worms in *fresh* seed, nor have we read of any who has; whence we infer that they are not the *cause* of the disease, but that the potato has been previously injured so as to produce rottenness in whole or in part, and that in such a state it presents attractions to, and affords facilities for the entrance of these worms, which it did not when fresh and sound. *2dly*, That the worms appearing in the diseased plants have always entered upon the cut side; and have never, so far as we know, made their way by the eye, or through the skin of the potato. We therefore conclude, that, as a considerable time elapses before these worms thoroughly penetrate the potato, the seed, if not previously and vitally injured, has sufficient time to shew signs of life, which we know in innumerable instances it has not done. *3dly*, That the rottenness of the seed has frequently been observed to a greater extent than the inroads of the worms; from which we infer, that, as the excavations of the worms can have no more injurious effects than the incision by a knife, the potato must have been diseased previously to the entrance of the worms. *4thly*,

That we have observed numbers of the same species of worms around the potatoes planted this year, but have not discovered any of them *in* the seed, nor have we seen any attempts made by them to perforate the surface; whence we conclude, that the seed planted this year, being fresh and sound, is not in that state which renders the potato proper food for them, and that, until decomposition commences, the worms have no inclination to touch it.

The sum of the above remarks is, that worms have not been found in the fresh seed, but always in such as was more or less rotten; that their entrance on the side farthest from the germ of the potato, and the length of time necessary for the worm to penetrate to the seat of life, allowed sufficient time for the potato to vegetate, had it not been injured by previous disease; that the bite of the worm can no more injure the seed than the cut made by a knife; and that seed planted this year, known to be sound, has lain among the worms uninjured, and produced vigorous stems. We, therefore, entirely dissent from the opinion, that the worms have more or less occasioned the failure of the crop, or the disease in the seed. Our belief is, that the seed has been heated either in pits or when lying in heaps after being cut; that the seed was thereby deprived of life, in consequence of which fermentation and decomposition set in; that worms are not necessarily found in this vegetable when in process of decomposition, but, being amongst the manure, and finding the potato in that corrupted state, which fits it for food to them, they desert their ordinary fare, and burrow in the decaying potato. Their presence, therefore, we believe, is not the *cause* but the *consequence* of that injury which the seed has received. [The application of the principles here maintained, namely, that the cause of the failure is to be ascribed to the injury of the seed from heating, is then made to the several cases particularly adduced by writers on the subject, and the facts are shewn to harmonize perfectly with the theory proposed.]

But a question still remains to be answered, and which we

admit is difficult of solution. It is this:—If heating has been the cause of injury to the potato crop of last year throughout the kingdom, why were not the same effects produced in former years? To this we reply, that partial failures of the crop may have arisen from the same cause in former years, but, being partial, they did not attract general notice.

Again, it is only of late that this crop has come to be extensively cultivated in many parts of the country. Formerly potatoes, in many districts, ranked in the scale of importance with cabbages, greens, and other culinary vegetables, whose failure annoyed the housewife more than the farmer. The quantities of seed lying together, prepared for more extensive planting of late years, have increased the danger, and occasioned more damage, than formerly occurred. The practice of planting late in the season, often near Whitsunday, which has much prevailed of late, does not give the potatoes sufficient time to ripen, so that, when taken up, they contain a greater quantity of sap than when fully ripe, and are thereby exposed to the danger we have already described.

The state of the weather, which we mention last, has been perhaps one of the most powerful exciting causes of this evil; and in a variable climate, such as ours, it might be a sufficient answer to the question to say, that, while scarcely two seasons pass over precisely of the same nature, it is not to be wondered at, if phenomena should be produced in one season, in the vegetable kingdom, such as have not occurred for years, or never in the recollection of man.

The common proverb, that “the knowledge of a disease is half its cure,” applies, we apprehend, with peculiar force to this subject; and if we have succeeded in explaining the nature of the disease, we think we should do little less than insult the intelligence of the agricultural community, were we to throw out suggestions for preventing an evil which may be so easily avoided.

Note.—[It is almost unnecessary to observe, that the term “seed” is used in the above essay, to designate the sets or tubers, and not the real seeds of the potato.]

ESSAY II. *By Messrs MALKER and WINDER, Liverpool.*

THE authors of this Essay decidedly reject the notion entertained by some persons, that insects were the cause of the defect, and are of opinion that insects are merely attracted by the set or tuber when in a state of decay. Ever since the partial failure in 1832, they had directed their attention very particularly to this subject, and after minute observation and strict inquiry, in Lancashire and the district of Kintyre, they arrived at the conclusion, that to the extreme mildness of the winters, in conjunction with improper management, may be attributed the defect which now, as they believe, prevails among, perhaps, all varieties of the potato. Although farmers are generally unwilling to admit that their mode of management has at all contributed to produce the injury, yet they cannot avoid acknowledging, that, a few years ago, their potato crops were much less extensive than now; that they then planted earlier; that they deferred digging them until the tops were entirely dead and broken down; that they employed but few hands in the digging, and allowed the potatoes to remain in the fields a while, in small covered heaps, to dry and season before they stored them; and that, in storing, they deposited them in moderate quantities together, in dry and airy buildings, or in narrow pits, covering them well when in pits with straw, dried fern, or dead tops, as well as with soil, and allowing sufficient ventilation. Of late, on the other hand, the potato crops have become very extensive; planting is performed at a later period; they commence digging up the potatoes earlier, and while many of the tops are yet green; they then put on all the strength they can muster for the digging, and hurry off the potatoes to the houses or pits without allowing them any time to dry or season, even though they be wet and dirty; and in storing, in many parts of Ireland and Scotland especially, they heap them up to the height of twelve

or fifteen feet, or even more, in houses from ten to fifteen feet in width, without any partition, and in many cases without any ventilation; or they hurry them into large and roomy pits, sufficiently capacious to contain upwards of two tons in the length of a yard, and at once cover them up with a heavy coat of earth, with little or no straw, and without any vent for the escape of steam.

The consequence of this management is, that, when the winters happen to be unusually mild, the potatoes become greatly injured by being overheated in the houses and pits, which induces premature vegetation, and eventually a species of disease; and that when taken from such stores and planted, the sets prove weakly, and are often incapable of germinating with sufficient vigour to form strong plants. That the injury has originated from such overheating the authors are convinced, from their examination of stocks in pits and houses, as well as of cargoes brought from various parts of the kingdom, among which the fermentation had often caused grievous loss.

Potatoes intended for being planted ought not to be dug before they are ripe, otherwise they never keep so well. Even when fully matured, and put together in small quantities, they undergo a certain degree of fermentation on being stored; but when put up in large quantities, and in an immature state, they both undergo more heat, and are less capable of resisting its influences. Many instances might be adduced in proof; for example, it has happened that potatoes taken from the centre of a house failed entirely when planted, while others taken from along the walls answered well under precisely the same management; potatoes from the south end of a pit have failed, while others from the north end have answered; and a member of the Liverpool Agricultural Society having planted eleven different lots of potatoes, found that, while those which had been dug and pitted in the usual manner failed more or less, those which had been kept cool, and free

from premature vegetation, in dry cellars and airy buildings, produced fine crops.

It is therefore of great importance that potatoes should not be dug until fully ripe, and that they should be so kept as to prevent heating. The authors are of opinion that it is a dangerous practice to cut the seed some days before planting, as many do, to allow the cut side to heal over; and that the manure should be incorporated with the soil previous to the time of planting. In many instances they found the failures to have taken place where the sets had been placed in immediate contact with the manure, and few, if any, were observed where the manure or sea-weed had been previously incorporated with the ground. Another argument in favour of the latter practice is, that the replanting has been almost universally successful; which, no doubt, arose from the circumstance that the sets were seldom placed in direct contact with the manure, or because the latter had become less injurious to the seed than when put in fresh from the farm-yard. When sets are planted in direct contact with the manure, it has also been found that they succeed much better when the skin side is placed next to it; whence it is clear, that the sets require a skin to protect them from its influence, and, therefore, that the tubers ought to be planted whole, a practice recommended as being not only the safest, but the most profitable with respect to the quantity and quality of crop.

Some are of opinion that potatoes are fast degenerating; but the authors think that any diminution which may have taken place in their natural vigour is owing to their having been overheated in houses or pits, and thus prematurely forced to vegetate; and with respect to their permanency, they are inclined to believe with Mr Lawson, "that any variety of the potato, cultivated by means of tubers, may be continued unchanged to any length of time, provided due care be employed in its culture." But as it is evident that potatoes are at present weakly and defective, some means ought to be

adopted for remedying the evil. Hard winters would, no doubt, be salutary, but as we cannot calculate on being visited by them, we must be on the alert to guard against the effects of mild seasons. Recourse ought to be had to seed from crabs, and, in the mean time, the tubers ought to be planted whole, or the rose end only, or the halves of tubers cut through the centre longitudinally. The manure should be incorporated with the land, or a compost should be used in the drills in place of unmixed farm-dung; or, at all events, the soil should be raked or brushed over the manure before depositing the sets.

The sets should be of large size, and planted as soon as cut, with the skin side towards the manure. The best time for planting is the month of April, earlier or later according to the state of the land and weather. If the season be hot and dry, great care should be taken to retain as much moisture in the land as possible; for which purpose it would be well to plough tolerably deep, and refrain from opening the drills or planting during the heat of the day. The crops should be thoroughly ripe before they are dug, and, after having been allowed to dry and season on the surface of the land, they should be stored so as to be kept dry, cool, and free from untimely vegetation, whether kept in cellars, potato-houses, or pits. Expedients for effecting this will readily suggest themselves; but in the case of pits, the authors recommend that, when putting in the potatoes, narrow wicker-work funnels should be stuck up, at regular distances along the centre, thus leaving cavities or chimneys, from the bottom of the heaps, for the escape of steam; when heaped up, the potatoes should remain a while uncovered, except with dead tops, dried fern, or straw, with the addition of tarpaulin covers over all at night and when raining, until sufficiently seasoned, when they may be finally covered with earth; sods being then laid over the chimneys at night, and during rain or frost, to prevent injury.

The other Essays with which the Society has been favoured, generally agree with the above, both in respect to the causes of the failure, and the means of preventing it in future. Owing to the limited space which can be devoted to the subject, it is impossible to give in full the various facts and observations contained in these valuable papers; but a selection is here offered of the more interesting.

MR ROBERT FAIRBAIRN, Grange Cottage, Causewayside, Edinburgh, states, that having in 1834 examined several fields in the neighbourhood of that city, some of which were an entire failure, he found the potato sets for the most part entirely rotten, and those that were not, in a sickly condition, although very few insects were observed. He recommends that the potatoes, when taken up, should be well aired and dried, and kept during the winter so as to prevent heating. When cut for planting, they should never be put in a heap, nor allowed to remain unplanted more than a fortnight or three weeks, otherwise they are apt to become so juiceless, that, if planted among dry dung, especially in very dry weather, they are apt to fail. He also recommends incorporating the dung well with the soil, and states, that whole potatoes produce a much better crop than cuts; but is of opinion, that, when planted whole, they should never be much larger than a pigeon's egg, and none smaller. The practice of picking the growths is very injurious, and steps should be taken to prevent the necessity of having recourse to it, as the first shoots always produce the most vigorous plants.

MR JAMES WALDIE, Berbeth Mains, Ayrshire, states a number of facts tending to prove that the principal causes of the failure were the heat and drought which succeeded the planting of the potato. The insects which frequently appeared, he thinks, were merely consequent on the putrefaction of the sets. When the weather is moist, and the ground in a damp state, horse-dung in the middle stage of putrefaction is preferable to the ordinary farm-yard dung, and

ought to be applied below the potato sets; while in dry seasons, farm-yard dung is preferable, and ought to be used when in an advanced stage of putrefaction. During drought, the sets should be earthed, and a roller passed along the drills. His opinion is, that the drought and heat during the two preceding seasons in a great measure caused the failures that took place in the potato crops in various parts of the country; more particularly when the seed had been rendered weak by fermentation, or from having been planted too often in the same kind of soil. Failures, he states, have been more general in the vicinity of towns, the reason of which is, that people living in towns are frequently obliged to keep their potatoes in places ill adapted for them, so that the nutritive juices are more or less expelled, and the tubers become shrivelled, by which their germinating powers are diminished. Potatoes to be used for planting ought to be taken up before they become fully ripe; and to secure seed of a superior quality, they should not be planted beyond two seasons on the same kind of soil. Indeed, in all situations, a change of seed is absolutely necessary; and potatoes obtained from upland districts answer best in the lower grounds.

Mr W. ANDERSON, in a communication transmitted by Mr Andrew Graham to Mr Waldie, and by him to the Society, agrees entirely with Messrs Macdonald in attributing the cause of the failure to the fermentation of the seed-potatoes, to prevent which, they should be properly stored during the winter, planted whole, and carefully kept from contact with dung having too much moisture, or of too rank a quality.

Mr JOHN McClymont, Balsaggart, Ayrshire, in a paper read to the Carrick Farmer Society, and transmitted along with the two last, mentions several facts, from which he infers that the cause of failure was in the seed-potatoes, and might perhaps have been induced by previous bad management; that potatoes so weakened or diseased may grow under favourable circumstances, as when supplied with moisture, or

fail when planted in sandy soil, and subjected to heat and drought; but sound healthy potatoes, brought from an elevated situation, will grow under the most disadvantageous circumstances. He recommends that greater attention be paid to the selection of seed-potatoes, and that potatoes intended for seed the following year be planted on new damp or moss-land, rather late in the season, and with an extra quantity of rich cow-dung, the effect of which will be to keep the crop longer in a growing state. The potatoes should be taken up before they are ripe, and stowed in narrow pits in a dry situation.

MR THOMAS McVITIE, Craigshields, Dumfriesshire, on the contrary, is decidedly of opinion that potatoes should not be taken out of the ground before they are perfectly ripe, and states, that he has in many cases traced the failure of crops to the practice of lifting the potatoes when immature. With regard to the drying of potatoes, and securing them during the winter, his observations agree with those of Messrs Walker and Winder. When there is any doubt about the healthiness of the seed-potatoes, he recommends planting the tubers whole. The failure of the crops of 1833 and 1834 he attributes to the want of care in selecting proper and approved kinds of potatoes; the too hasty introduction of varieties not sufficiently known; the raising such as were intended for seed at too early a period; the pitting them before they were dried; employing unripe or fermented potatoes for planting; and cutting the tubers, instead of planting them whole.

MR JAMES WADDELL, Dunoon, Argyllshire, is convinced that the failure has not been caused by the nature of the ground, the kind of manure, or by insects, but by a defect in the seed-potatoes, occasioned by the practice of lifting them at too early a period, heaping them together in pits covered with earth, so as to exclude the air, and planting too late in the season. He rejects the idea that it has been caused by insects, or by the state of the weather, or, in short, any other

cause than that above mentioned, and recommends that the greatest care should be taken to prevent heating after the tubers have been cut for planting. For this purpose, as well as to obviate their tendency to dry, he recommends, that when the potatoes are split and laid together in a heap, there should be mixed with them, as they are put up, a good quantity of dryish earth, which will not only produce the desired effect, but cause them to shoot as if they had been planted, by which it will be seen if they are sound. He states, that having at different times planted the tops or rose-ends, he found the crop two weeks earlier, and that in this manner the greater part of the potato may be saved for food.

Mr SMITH of Penfillan, in a letter to Norman Lockhart, Esq., communicated to the Society, thinks that the cause of disease is not altogether in the seed, and that the surest way to obtain a good crop would be to put in the dung some weeks or months before the potato. It is quite evident, he says, that potatoes planted in a dry soil, on a dry day, upon dung saturated with urine, will not now grow, while there is equal proof that the same potato planted in cold or wet weather will grow; and there is equally good evidence that, planted on dung put into the ground six weeks before the potato, a good crop may be calculated on.

Mr JOHN CAUGHY, Belfast, states, that healthy potatoes of medium size, grown in an upland situation, and lifted rather before they are ripe, should be selected for planting. Potatoes designed for seed ought to be planted late, that they may be late in budding, and so not subject to partial exhaustion, by having the buds taken off before planting. When cut for seed they ought to have some such thing as lime strewed over them to prevent the escape of the moisture. Heat is very detrimental to potatoes when heaped together, and it has been found, that of potatoes taken from the same heap, some may grow, and others not, according as they may have chanced to come from the outside or the interior of the heap, where there

has been heating. The production of small tubers or knobs by sets in dry soil, noticed by Messrs Macdonald, has also been observed by Mr Caughy, who, in fine, appears to attribute the failure to the great heat and drought of the season.

Mr WILLIAM WILSON, Taylor's Land near Gastown, Dumfriesshire, in a paper communicated by Mr Monteith of Closeburn, is of opinion that the evil has arisen chiefly from the careless manner in which the pits are formed, in consequence of which the potatoes are heated. Potatoes of different kinds should not be put together, as the earlier act upon the later kinds, and fermentation ensues. When there is any doubt as to the soundness of the tubers, they should be cut large or planted whole; and the planting should be performed between the 26th April and 16th May. Green potatoes are full of a weak watery sap, and yield a very inferior quantity of flour, from which it is evident that they are defective and altogether unfit for being planted. To prevent canker or rot, a wash of salt and water, mixed with lime, may be used for the sets; and to ensure healthy potatoes, the plant should be frequently renewed by means of seed obtained from ripe plums or berries, or the top-eyes of tubers may be used, which not only renovate the potato, but produce the most luxuriant crops.

Mr JAMES KENNEDY, Lochlands, near Maybole, has been led to ascribe the defect, not to any inherent defect in the potato itself, nor to insects, but to a combination of causes connected with the mode of planting and general treatment. Failures, he says, have taken place chiefly in clay lands, or in light sandy soils. The former not being reduced to minute particles, leave the sets exposed to the influence of the air and sun, which disperse their moisture; and the latter allow the same result to take place, unless the sets have been placed at a sufficient depth. Tubers, when cut, are more liable to be injured than when planted whole. They should always be cut some days before planting, that the wounds may dry up;

but if they be cut some weeks before, care must be taken to prevent their losing their moisture, which would render them unfit for germinating. In dry seasons, they should be planted beneath the dung, and well covered over with earth, both in sandy and in clayey soils. The great heat and drought of April and May in 1833 and 1834, combined with the mismanagement of the sets, in a great measure account for the failures.

Mr JAMES JACKSON, Plaintiff Shade, by Penicuick, states that the appearances presented by the sets which did not braird, were the following:—1. A feeble effort at vegetation had been made by some, there having been sent out a small shoot, surmounted by a tuber little larger than a pea; the sets were in most instances attacked by worms and other insects, always on the cut side, and never on any part of the skin. 2. In other instances, the sets remained entire, and, although their vegetative powers were suspended, they had no appearance of being injured. 3. Others were converted into a putrid pulpy mass, but retained their original form, and were uninjured by insects. He is of opinion that fermentation of the tubers, together with the peculiar nature of the two last seasons, and the consequent state of the ground and dung, has been the cause of the disease. Seed potatoes should be obtained from other and higher districts; the rose ends only should be planted, and the berries should never be allowed to grow on potatoes intended for sets.

Mr BRYCE WRIGHT, Woodland, Girvan, Ayrshire, is precisely of the same opinion as Messrs Macdonald, and attributes the failure to the fermentation of the potatoes previous to being planted, the danger of which, he says, is increased by the practice of lifting potatoes before they are ripe. In consequence of mismanagement heating takes place, and a kind of putrefaction is the result. To preserve the potato in a healthy and vigorous state, and to prevent any failure in future, let the two following rules be attended to:—1st, In selecting potatoes for seed, always choose those which have strong and

healthy tops, allow them to remain in the ground till fully ripe, put them up in thin elongated pits upon the surface, with a sufficient covering to exclude wet and frost. 2d, Let the pits be removed or turned over in spring, for the purpose of keeping down the growth, let the potatoes always be cut in the shade in sunny weather, and let the operation of planting be got speedily over, so that the dung and sets may be as little exposed to the air as possible.

MR GEORGE HERRON, gardener, Kilwinning, Ayrshire, in a short but satisfactory paper, gives a statement of facts and forms conclusions entirely in accordance with those of the last mentioned writer, the Messrs Macdonald and others.

MR PETER COWAN, farm overseer, Antrim Castle, Ireland, states that the appearances exhibited by the sets which had failed were similar to those mentioned above, as observed by Mr James Jackson. The failure cannot, he says, be attributed to the management of potatoes after being dug, for it has not been different these twenty years back; nor to the potatoes being immature, "for unripe and watery potatoes make the best seed-roots," the "watery matter being the germinative principle;" nor to the attacks of worms or insects, for where these have been found the sets were always putrid. The doctrine of excretions from the root causing disease he treats with contempt, and states as decisive with respect to it, that, "in the gardens of the poor, where potatoes have been grown every year for scores of years, there has scarcely been a failure, certainly not one for ten which have occurred in fields where several crops intervene between two of potatoes." The failure he is disposed to attribute to the peculiarities of the weather; but, without absolutely asserting this to be the case, he thinks it may in future be prevented by planting whole potatoes, or, if cut, by planting them immediately afterwards, turning the cut side downwards; or, if not planted immediately, by using lime on the cut surface, to prevent the escape of the watery matter. But, when immediate planting can be adopted, and the land has been thoroughly prepared, liming is perhaps unnecessary.

“**HORTULANUS**” agrees in his remarks with Messrs Macdonald, Messrs Malher and Winder, and so many of the other essayists. Potatoes cannot, he says, be over ripe for seed, and they ought to be carefully stored so as not to be heated, or have their moisture exhausted.

An anonymous writer has sent an account of the qualities of several varieties of potato, but his observations have no direct reference to the subject in question; and of the other letters or communications addressed to the Secretary or other members on the subject, it is unnecessary to speak.

GENERAL REMARKS.

On the whole, it would appear, from the evidence adduced, that the partial failure of the potato crop has been owing to the following causes:—The plant itself does not appear to have become materially deteriorated by having been so long in cultivation; but various circumstances tend to injure it. A principal cause of injury seems to exist in the partial heating or fermentation which potatoes undergo, when heaped together in an improper manner, so that their vegetative powers are impaired. Their power of resisting the effect of heating, as well as of drought after planting, is lessened by the practice of lifting them before they are matured, and by that of throwing the sets into heaps before being planted. While most of the writers are decidedly of opinion that potatoes for planting should not be lifted until fully ripe, others allege that unripe potatoes germinate better, and this chiefly on account of the greater quantity of moisture which they contain. But, in the first place, it is well known that perfectly ripe potatoes germinate and grow well; and, secondly, that unripe or watery potatoes neither retain their moisture, nor resist heating so well as ripe ones. It seems, therefore, preferable to adopt the practice against which least can be said. When potatoes, after being cut, are thrown into heaps, and the weather is warm, they appear to be peculiarly liable to be injured, as, on

account of the moisture that exudes from them, the fermentation into which they are apt to run is accelerated. An uncommonly mild winter may act very injuriously, both by promoting fermentation, and by causing the process of germination to commence at too early a period, in consequence of which the tubers, which have been perhaps repeatedly picked, have their young stems weakened, while, should great drought follow, the sets will lack moisture to afford them nutrition. The practice of cutting the tubers must always tend to weaken them, for which reason, when placed in fresh or wet dung, the acrid exhalations may cause them to putrefy, or, when placed in very dry soil, their moisture may be exhausted. Tubers or sets, weakened by whatever cause, must be very liable to be destroyed by particular states of the weather, which may occasion a failure in one year and not in another. Thus, should the winter be remarkably mild and wet, and the end of spring and beginning of summer remarkably dry and hot, as was the case in 1833 and 1834, the former would necessarily promote heating and premature sprouting in the tubers, while the latter would tend to destroy the little life that remained in the sets, by drying up its sources. When there is any doubt as to the soundness of the tubers, they ought to be planted entire. In any case, if cut, they ought to be planted as soon as possible; and perhaps, where it is difficult to do so, the sets might be covered with lime, or some other substance, as recommended by several of the essayists. Most of the writers are agreed that the dung or manure should be well incorporated with the soil, and it is obvious that the sets ought to be sufficiently covered, and placed at a proper depth. In short, were the degree of attention which so valuable a plant deserves, bestowed upon the raising, preserving, and planting of the tubers, there would probably be few instances of failure, seeing the species is so remarkably hardy, and so capable of accommodating itself to every variety of soil and climate.

To conclude; in whatever manner the discordant statements made by some of the writers of these essays may be

viewed, it would seem that the best supported opinions are to the effect, that the cause exists in the deterioration of the tubers by injudicious management, and that it may be prevented by preserving them from being heated, and generally by bestowing more care on the cultivation of this most useful plant. With respect to insects having caused the failure, almost all are agreed that there is no foundation whatever for such an opinion, and that wherever worms have been found, they have been a consequence, and not a cause, of the partial or entire decay of the sets.

It is gratifying to find that the views of Mr Anderson, to whom the Royal Dublin Society adjudged the premium offered by them in 1834, for the best essay on the cause of the recent partial failure of the potato crop, are exactly in accordance with those of the majority of the writers who have favoured the Society with their observations. "I have already stated," says he, "that during nearly two hundred and fifty years there were no instances of failure similar to those which have lately occurred; and I have ascribed the recent failure to our altered system of cultivation, deferring the time of planting to a later period, and taking up the crop in an immature state. I shall now endeavour to explain and illustrate the evil consequences of this change: The potato lying in the ground during the winter becomes perfectly matured, retains its juices, is preserved from fermentation, and germinates at the natural season; and we have found that the plant proceeding from it is luxuriant and healthy. Under our treatment the tuber is taken up immature. It has, therefore, a greater tendency to fermentation, from its juices being more crude. It is heaped up in large quantities, in close houses or pits, and these large heaps increase the tendency to fermentation. The time of planting is protracted beyond the natural period of germination, and the tubers become exhausted by germinating in the pits; and when at last committed to the ground, they are frequently planted in mould which has become dried up, and not unfrequently placed in manure which

is also dry and withered, from improper preparation or neglect ; and are sometimes put into ground so rough, and ill prepared, that the air is freely admitted to the seed, to dry up any moisture that may remain. If seed be perfectly sound and uninjured, it may be able to surmount the obstacles which improper management at the time of planting opposes to its germination ; but when injured, and its powers of germination weakened, it may fail to overcome them."

NOTE RESPECTING THE CULTIVATION OF THE POTATO. *By the Rev. JAMES FARQUHARSON, Alford.*

THE accompanying sample of potatoes is produced to the Highland Society, in reference to a short paper of mine which the Society honoured with a place in their printed Prize Essays and Transactions, (vol. x. p. 306), and stating, from experience, that large potatoes, when used for plants, produce, under equal circumstances, a heavier crop than small ones.

They are of the early variety, there stated to have been, from year to year, since I first got them in 1826, increased in their produce, by a selection every year of the largest potatoes for planting. There is this year about half a Scotch acre in crop with them, of a rich dry well manured soil, and the produce, ascertained by taking up and weighing the crop of a measured space, is great, being 17 tons, or 68 bolls of 560 lb. avoirdupois each, per imperial acre. They were planted in 30 inch drills with the plough in the last week of April, but not exceeding 6 or 8 inches distance in the drills, as the stems of the variety are small, and do not occupy much space. They came into use for the table the first week of July, but were not then quite ripe, which, however, they were by the end of that month. It is stated in the published paper referred to, that the quality and flavour are good for the table, as an early potato, and that it keeps well ; and that these circumstances, in addition to its early ripening, suggest-

ed the expediency of raising it for the cattle in a district where the later varieties are liable to be often hurt by hoar-frosts in August and September, before they are fully ripe. A great proportion of the crop is as large as the sample, and there are very few potatoes in it that could be properly named small ones, although, when I got them eight years ago, all were small and the produce scanty.

Another note is worthy of attention. The potatoes, however large, are never cut into more than four pieces for plants, and that through the nose, or end most remote from the parent stem, to leave in every plant some of the eyes near the nose, which, as is well known, produce the earliest and most vigorous shoots. This I had neglected to state in the communication to the Highland Society.

DESCRIPTION OF AN IMPROVED DOUBLE ACTION-PUMP FOR
RAISING WATER, AND AN IMPROVED SYPHON. *By Mr
MIDDLEMISS, Montrose.*

THE subject of this notice was brought before the Society at the Annual Show held at Aberdeen in October 1834, and though the pump exhibited in model is not a new invention, having at different times been brought out by different individuals, yet as it seems to possess some advantages over the common pump, with very little more expense, it may be useful to give a description of it.

In this pump, represented in the annexed cut, Fig. 1, the working barrel and suction-pipe differ in no respect from the common sucking pump, and are besides furnished like it with two valves. In this double action-pump, however, the valves are both moveable or *working valves*. The rod or spear of the lower valve, passing through the case of the upper one, while the rod of the upper valve is carried up at one side clear of the other. The two rods so arranged may be worked in various ways, so as to produce an alternate reciprocating

motion in the two rods. The present arrangement, wherein two pumps are put in motion by one set of levers and working geer, is one of the methods proposed by Mr Middlemiss, and seems to possess every necessary requisite. It will be easily observed that, when either of the pumps is in motion, the alternate strokes of the two valves will keep up an almost constant stream issuing from the nozzle of the pump; for either one or other of the valves must be on the lift, and consequently discharging water. The necessary result therefore is, that in two pumps of equal bore, and under like circumstances, the one single, the other double action, the latter will discharge double the quantity of water, or nearly so, of the former. It must be observed, however, that it will require nearly double the power to work it; but there are many situations where power is abundant, and the demand for discharge of water great, in which case such a pump may be highly valuable. Mr Middlemiss has found that the usual foot, or lower immovable valve, can in this pump be entirely omitted.

The improvement which Mr Middlemiss has effected in the syphon, consists in the application of a small cistern, or funnel, A, Fig. 2, to contain a quantity of liquid, and having an air-tight plug and handle D fitted to the bottom of it, communicating with the longer leg of the syphon. A stop-cock C is inserted into the extremity of the longer leg. When the syphon is to be used the short leg B is plunged into the vessel, from which the liquid is to be drawn; a quantity of liquid is to be poured into the small cistern; the stop-cock is then opened, the plug of the cistern is lifted, admitting a portion of the liquid to pass into the syphon, sufficient to establish the current through it, when the plug is to be immediately returned to its place, and that before the whole of the liquid in the cistern has been expended; thereby retaining a portion to cover the plug and keep the air from entering. By means of the stop-cock, the discharge can be regulated or stopped at pleasure. In this syphon it is believed there is nothing entirely new;

the cistern and plug are a substitute for what has many years ago been done by a cistern and stop-cock ; and the stop-cock at the extremity has also been frequently applied, but, like the pump, this improved syphon may in many cases be useful.

Fig. 1.

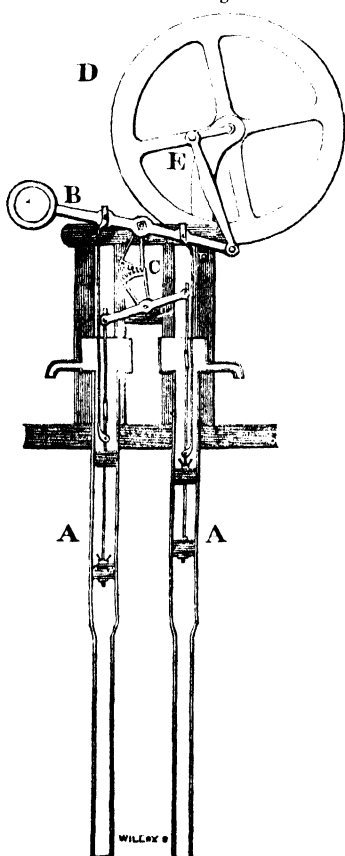
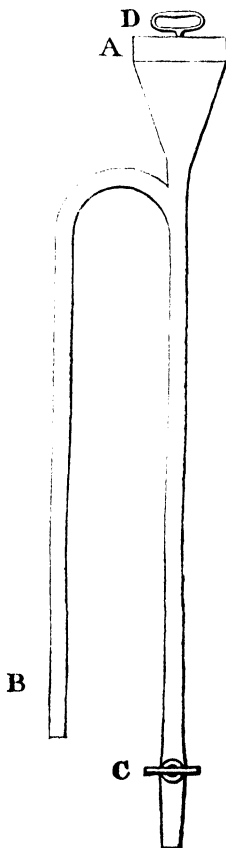


Fig. 2.



Reference to Fig. 1.

- AA, The working barrels of the pumps.
- B, Lever connected with the rods of the upper valves.
- C, Lever of the lower valves, and shewing also the connection of the levers by means of the toothed segments.
- D, Fly-wheel to regulate the action of the pumps.
- E, Crank and connecting-rod communicating between the fly-wheel shaft and upper lever.

EXPERIMENT MADE ON THE COMPARATIVE ADVANTAGES OF
FEEDING CATTLE ON RAW OR STEAMED FOOD. *Supple-*
mentary to a Report previously published. By Mr RO-
BERT WALKER, Ferrygate, Haddington.

ON the 20th of February 1833, I selected from my feeding stock four stots and six queys, as related at p. 253 of the tenth volume of the Transactions. Two of the stots were kept on steamed, and the other two on raw food. One of those fed on raw and one of those fed on steamed food were sent off to be slaughtered on the 10th June 1833. The other two, No. 8. and No. 10., were kept on, in order to ascertain the improvement the third year, until 11th January 1834, when they also were sent away and slaughtered. Their live-weights were regularly ascertained at the 20th February 1833, when put up to be fed, and at the 20th day of every succeeding month, during the time they were kept on. From 20th February 1833, until 25th May, when put to grass, the two stots on raw food consumed 140 lb. of Swedish turnips, 30 lb. of potatoes, and 4½ lb. of bruised beans per day, each beast. But the two on steamed food consumed considerably more turnips; for a statement of which see my Report on that subject to the Highland Society (vol. x. p. 253). From the 25th May until the 12th August, the two stots which were kept on, went in a very fine field of grass; they were again brought into the court-yard on the 12th of August, and fed upon second crop clover cut grass, what they could eat, with the old allowance of 4½ lb. of bruised beans per day each, the same quantity of beans being continued to the end of the experiment. On the 4th October they began to get, in addition to the cut grass, common white globe turnip. On the 1st December they were put on Swedish turnips, and continued on that food until sent away on the 11th January 1834. On getting the turnips on 4th October, they consumed very little cut grass, by this time the grass having lost its succulency; and it was altogether discontinued on the 14th of October, when they got oat-straw. They at no period were allowed any hay.

*TABLE exhibiting the Weight of the Animals during the Experiment.
The Stot formerly fed on Steamed Food marked No. 8, the one fed
on Raw Food No. 10.*

		REMARKS.	Live Weight in Stones.	Improve-ment per month in Stones.	Loss per Month in Stones.
1823.					
Feb. 20.	No. 8,	At beginning of experiments,	92		
— —	No. 10,	At ditto, - - - -	84½		
Mar. 20.	No. 8,	On steamed food, - - -	98	6	
— —	No. 10,	On raw food, - - - -	92½	8	
Apr. 20.	No. 8,	On steamed food. - - -	103	5	
— —	No. 10,	On raw food, - - - -	100	7½	
May 20.	No. 8,	On steamed food, - - -	106	3	
— —	No. 10,	On raw food, - - - -	108	8	
		Total increase on two year olds, } at three months, - - - }	-	37½	
June 20.	No. 8,	Out at grass on the 25th May,	105	-	1
— —	No. 10,	Do. do. - - - -	109	1	
July 20.	No. 8,	Do. do. - - - -	103	-	2
— —	No. 10,	Do. do. - - - -	106	-	3
Aug. 20.	No. 8,	After being 8 days in court-yard } on cut grass, - - - - }	108	5	
— —	No. 10,	Do. - - - -	108	2	
		Deduct loss of weight,	-	8 6	6
		Total increase for three months at } grass, &c. - - - }	-	2	
Sept. 20.	No. 8,	On cut-grass, &c. in court-yard,	113	5	
— —	No. 10,	Do. - - - -	111	3	
Oct. 20.	No. 8,	On turnips, &c. since 4th current,	118	5	
— —	No. 10,	On turnips, &c. since 4th current,	120	9	
Nov. 20.	No. 8,	Do. do. - - - -	120	2	
— —	No. 10,	Do. do. - - - -	124	4	
		Total increase for three months } on cut-grass, Turnips, &c. }	-	28	
Dec. 20.	No. 8,	On Swedish turnips, since 1st curt.	124	4	
1834.	No. 10,	Do. do. - - - -	126	2	
Jan. 11.	No. 8,	Do. do. - - - -	123	-	1
— —	No. 10,	Do. do. - - - -	130	4	
		Deduct loss of weight,	-	10 1	1
		Total increase for 1 mo. and 22 days,	-	9	
		Total increase for three year olds, from 20th May 1833, un- til 11th January 1834, being 7 months 22 days, - }		39	
		Total increase for two year olds, from 20th February 1833, until 20th May, being three months, - }		37½	
		Difference,		1½	

From the experiments we made upon two year old heifers, both last season and this, we found that they increased, upon an average, from five to six stones live-weight per month each. On referring to the foregoing Table, it will be seen that the two year olds in this case increased $6\frac{1}{4}$ th stones live-weight per month each, from the 20th February till the 20th May 1833. But by the same Table it will be seen that the average increase for the 7 months 22 days succeeding, was only about $2\frac{1}{2}$ stones live-weight each beast per month.

It would, therefore, appear that the two-year old stots increased in live-weight, during the first three months, $37\frac{1}{2}$ stones. Now, we have found by experiment, that the beef of a good fat beast is about $\frac{6}{10}$ ths of the live-weight, which would give about $22\frac{1}{2}$ stones of beef, at 6s. 6d. per stone, equal to L. 7 : 6 : 3, or L. 3 : 13 : $1\frac{1}{2}$ each beast for three months, equal to L. 1 : 4 : $4\frac{1}{2}$ per month. And, on the other hand, they increased only 39 stones of live-weight during the succeeding 7 months 22 days, when rising three year olds, which would give about $23\frac{3}{4}$ stones of beef, at 6s. 6d. per stone, equal to L. 7 : 13 : 10, or L. 3 : 11 : 11 each beast, for 7 months 22 days, being only about 9s. $3\frac{1}{4}$ d. per month each, for the third year's keep. Perhaps the difference of monthly payments between the two and three year olds, will be thought by some not to be fairly stated, inasmuch as the two year olds were worth as much per stone at the 20th May 1833, as the same cattle, when three year olds, were at the 11th January 1834. But this was not the case with the two year olds at the beginning of 1833, because we consider that they increased in value the whole carcass of beef, and that 6d. or 9d. per stone might have been added to the weight of beef at the 20th May 1833.

It is not to be rashly inferred, that because the cattle had increased in weight, that their capabilities of consuming food must have increased in proportion. On the contrary, we are rather inclined to think, that a two year old will consume

more food than a three year old, provided the beast had arrived at maturity at two years old; because, in this case, we found the two year old beasts consume 140 lb. of turnips, 30 lb. of potatoes, and $4\frac{1}{2}$ lb. of beans each; and the three year old ones only 112 lb. of turnips, and $4\frac{1}{2}$ lb. of beans each per day. In both cases the turnips were Swedish. We make this statement with considerable diffidence, as the trial with the three year olds was only for five days, by far too short a period for any one to found upon as conclusive.

	st. lb.	st. lb.	st. lb.
Weight of No. 8, when killed,	73 8 of beef;	10 5 of tallow;	and 7 3 of hide.
Ditto of No. 10, ditto,	77 0 ditto;	12 9 ditto;	6 0 ditto.

FERRYGATE,
22d March 1832.

REPORT OF THE COMMITTEE FOR THE PREMIUM OFFERED
IN 1833 FOR CURING OF BEEF AND PORK, IN THE COUN-
TIES OF LANARK, RENFREW, AND DUMBARTON.

Your Committee have it now in their power to report, that three competitors came forward for the premium of twenty guineas, offered by the Society in 1833, to the counties of Lanark, Renfrew, and Dumbarton, for the curing of *mess-beef*, under certain conditions.

The competitors were Thomas Neilson, John Lockhart, and John Bell, all of whom have conformed to the rules prescribed. The quantities cured by each stand thus:

Thomas Neilson,	. . . . .	45,954 lb.
John Lockhart,	. . . . .	31,800
John Bell,	. . . . .	24,600
Together,		<u>102,354 lb.</u>

The quality of the beef, and the mode of curing and packing, have had the attention of your Committee; and their award has been made, not only from personal inspection, but

from certificates under the hand of ship-masters, who have used the article as ships' provisions; and of planters in the West Indies, to whom it was shipped as stores. It is satisfactory to state, that, in general, these certificates have been highly satisfactory,—particularly as regards the finer qualities of beef, sent to the West Indies for planters' use. Against the beef supplied by Messrs Neilson and Lockhart, no complaint has been made; and it is but justice to them to state, that they have both been at great trouble to ascertain the proper methods of curing, &c. The former of these gentlemen has succeeded the best; and to him your Committee have unanimously awarded the premium.

Your Committee are of opinion, that, at present, no district in Scotland can derive that extensive advantage from the curing of beef which some parts of Ireland enjoy; because the Irish curer can undersell the Scotch in almost every description of salt provision. Your Committee, however, think that the premium has by no means been thrown away; as the result has shewn that beef can be cured in Scotland as well as any where else. In so far as the finer qualities, viz. planters' beef, are concerned, they decidedly think this branch of the trade will increase, and form a source of profit to the wholesale butcher or curer, which, of itself, will leave no cause for the Society to regret having offered such liberal encouragement to the grazing interest of the counties to whom this competition was opened.

No competitor came forward for the curing of *pork*, as it is difficult to obtain pigs which have been fed in this district in sufficient quantity. The supply, particularly from the West Highlands, is, however, rapidly increasing; and your Committee do not doubt that, in a short time, it will be more than sufficient for the home consumption.

ACCOUNT OF THE PRINCIPAL LIMESTONE QUARRIES OF SCOTLAND. *By Mr JAMES CARMICHAEL, Raploch Farm, Stirlingshire.*

[IN 1831, the Society offered a premium for the best account of the principal Quarries in Scotland, detailing the mode and expense of working, the quantities produced, and other essential particulars. Three essays on this important subject, by Dr Knight, Mr George Smith, and Mr James Blaikie, were published in the tenth volume of the Prize Essays and Transactions (p. 53). These essays referred to the granite quarries of Aberdeenshire, the slate quarries of the same district, those of the middle division of Scotland, and the sandstone quarries of the Edinburgh and Glasgow districts. In 1834, the Society, desirous of obtaining additional information, offered another premium for the best essay on the same subject, but particularly on the quarries of limestone and slate. It was adjudged to Mr Carmichael, who transmitted two separate essays, one on the principal limestone quarries, the other on those of marble, slate, sandstone, and greenstone. The first of these is here published. Excepting the deposits in Forfarshire, which appear to belong to the old red sandstone, the various quarries described may be referred either to the mountain limestone, or the limestone of the coal formation, the distinction between the two in Scotland not being sufficiently made out. The different beds, however, although inferior in thickness, are in their general character, as well as in their organic remains, analogous to those of the mountain limestone of England and other countries.]

LIME is one of the most generally diffused substances in nature. It abounds in the bosom of the earth, the bed of the ocean, and the bones of animals. To the agriculturist, the architect, and the chemist, its properties are well known, and by them it is duly appreciated. How sterile must have been the soil, how cheerless the dwellings, and how scanty the resources of Britain, before lime came into general use ! It is therefore of great importance to possess accurate information respecting the deposits of this most useful substance that occur in our country ; and of the various subjects proposed by the Society for investigation, the state of the limestone quarries in Scotland is by no means the least interesting. It is indeed matter of surprise and regret that the subject should have so long been neglected. But the truth is, that these quarries are scattered over so broad a surface, and many of the more extensive deposits are placed so far apart, that he who would examine them must have time at command, and must not expect to accomplish his task without labour. In this essay, however, nothing will be brought forward that has not been the result of personal inspection and careful inquiry. Indeed, many lime rocks were visited which I have refrained from noticing, partly because they are comparatively unimportant, and partly because I have been anxious to avoid prolixity ; and, in fact, such is the want of enterprise, method, and machinery, observable in most of the quarries, that it becomes difficult to make a proper selection, or present a satisfactory account of them. In some instances, the workings are carried on in direct opposition to the natural bed of the rock, which greatly increases the labour and expense of the operation ; whereas the slightest attention to the cleavage and cross fracture of the stone, would at once point out the easiest mode of quarrying any rock. In some cases, however, this deviation is unavoidable, as in those mines and open quarries where the dip of the rock or of the incumbent strata renders it impossible to adopt any other course. There are also several quarries so com-

pletely blocked up with *red*, as to be little better than rubbish pits. I would therefore, in the outset, urge all who are interested in quarries of any description, to employ a regular method of disposing of the refuse, before it attains an unwieldy magnitude. Where the waste is chiefly composed of earth, it may soon be converted into soil again, and where it consists of other stones which occasionally cover, or alternate with limestone, they may be profitably applied to the purposes of draining, the advantages of which are as yet but partially understood, insomuch that large tracts of wet land yet remain near several of these quarries, without so much as a single drain in them.

It may here be remarked, that limestone rocks, like most others, are by no means uniform in their direction or dip, nor does the crop always indicate the true inclination of the main bed, which often undulates in the same manner as the overlying strata or surface soil. And thus in a conical hill, such as the Roman Camp near Dalkeith, the lime rock dips all round; whereas at Brechin, and in some other places, the strata of the same deposit are bent so as to form various angles. Sometimes the bed appears suddenly disrupted by the intrusion of whin-dykes, or strata of other substances. Some of the most striking effects of such violent convulsions of nature are to be seen in the ravine immediately south of Arniston, in that near Vogrie in Mid-Lothian, at Cumbernauld in Stirlingshire, and below Old Cumnock in Ayrshire, where the solid limestone rock, and all its accompanying strata, are absolutely rent asunder, so that a chasm several hundred feet in depth and breadth has been produced, and the strata in all these quarries run in different directions, dipping to the south on one side of the chasm, and to the north on the other. All the limestone works examined along the sea-shore, excepting the precipitous ones at Charleston in Fife, dip into the sea. The same was also observed of all the other rocks reposing apparently on a flat or unbroken beach.

The colour of limestone does not afford a criterion by which its quality can be determined. It appears to be often influenced by the nature of the accompanying rocks. Pure limestone loses about two-fifths, or forty per cent. of its weight in calcination, which affords a good practical test of its quality. The specific gravity is not so decisive. Thus the Burdiehouse limestone is 2.6, that of Duddingstone 2.5, yet both contain 99.7 of carbonate of lime; while the limestone of Middleton quarry, which has a specific gravity of 2.5, yields only 94.5 of carbonate.

Before entering upon a description of each quarry, I may here remark, that the general results have been thrown into a tabular form, so as to afford a comparative view of the quality, quantity, and price, with the amount in imperial bushels. With one solitary exception, I have everywhere met with the most obliging readiness to impart all the information that I required. In many cases, however, it would have been improper to urge inquiries respecting rents and profits; nor is it always possible to afford accurate information on these subjects, especially in cases where quarries are let in connection with farms. In some cases, however, there is a separate rent, chiefly a lordship of a sixth, seventh, or eighth of the amount of sales. When the men work by the piece, they invariably provide the gunpowder, which in some quarries costs upwards of L. 100 per annum, and also keep up the tools.

Quarries of the Lothians.

I shall arrange the different quarries which I have examined according to their natural proximity in the districts where they occur, beginning with those of Mid-Lothian.

1. *Burdiehouse and Gilmerton Quarries*, parish of Libberton, rented by Messrs Torrance. This is perhaps one of the oldest lime-works in Scotland. It is still extensive, and the lime is highly prized both by agriculturists and builders, especially the latter, who are now the principal consumers.

The direction of the wrought rock is east and west, the dip about 45° , the inclination south. It was at one time worked as a mine, for which the overlying sandstone and shale afforded a smooth roof; but, having ceased to be level-free, it is now an open quarry of from 20 to 26 feet of limestone, with a covering of from 30 to 50 feet, which, together with the loss of labour, occasioned by the numerous dykes rising from south to north through the whole quarry, varying from 2 to 20 feet in breadth, and composed of masses of broken limestone and spar, by the quarriers termed *trouble*, renders the operations expensive. The rest, however, is pure limestone, but very difficult of calcination, requiring one boll of coal to prepare an equal quantity of lime. The coal, which is contiguous, costs 9d. per boll (4 cwt.) Fifty men at 12s. each per week, and sixteen horses, are employed. The lime is laid down in Edinburgh at 2s. 3d. per boll, pease measure (nearly 4 bushels). The quarrying is entirely effected by blasting, and the stones are conveyed to the kilns in small waggons on an inclined plane and rail, by means of a chain and drum moved by one horse. The kilns are of the common form, and contain from 50 to 150 bolls each. The annual sale is about 15,000 bolls. The Gilmerton bed, being nearly exhausted, is only worked for plaster lime, for which the other is said to be unfit, on account of its richness and tendency to blister. The Burdiehouse limestone has attracted much attention on account of the number and variety of organic remains, animal and vegetable, that occur in it, such as teeth, scales, and bones of fishes, coprolites, ferns and other plants, of which there are fine specimens in the museum of the Royal Society of Edinburgh.

2. *Mount Lothian Quarry*, parish of Penicuik, rented by Mr Stevenson, is of easier access, the rock being nearly horizontal, or but slightly inclined to the north-east, with a thin coating of peat over a stratum of red clay, intermixed with fragments of limestone, in all 4 feet deep. The lime beds are from 10 to 12 feet deep, divided and subdivided into

squares of various dimensions by cross joints. The lower bed is 4 feet thick, of excellent quality, and rests on clay. Ten men at 10s. per week, and two horses, are employed. The coal cost 1s. 8d. per cart at the kiln. One cart burns five bolls of lime. The annual sale is 15,000 bolls of lime, corn or barley measure, at 1s. 8d. per boll.

3. *Fullarton Quarry*, parish of Penicuik, rented by Mr Reath. This work is close to the above, and of similar quality. The lime bed is from 15 to 20 feet thick, the inclination 25° , the dip eastward, and there is a covering of from 12 to 20 feet of soil. Ten men at 10s. per week, and two horses, are employed. The cost of coal, and the proportion of it to the lime, are the same as in the last mentioned quarry. The annual sales are 8000 bolls at 1s. 8d. each.

4. *Side Quarry*, parish of Temple, rented by Mr Farm. This is another opening of the same rock. The bed is about 12 feet thick, and is overlaid by 1 foot of shale, and 4 feet of soil. The dip is to the east, the inclination 20° . Ten men at 10s. per week, and two horses, are employed. Coal costs 1s. 9d. per cart at the kiln; one cart burns four bolls of lime. Annual sales 1200 bolls at 1s. 8d. each.

5. *Bents Quarry*, parish of Linton, occupied by the Rev. D. Beresford, the proprietor. This rock is in various beds, the lower 7 feet thick, with several feet of inferior limestone above, and a covering of from 2 to 4 feet. Dip east; inclination 20° . Six men are employed, with 6d. per boll of lime sold, including quarrying and coal; 100 bolls of coal burn 200 bolls of lime; 4d. per boll allowed for all extra lime produced over these quantities; annual sale 6000 bolls at 1s. 4d.

6. *Whitefield Quarry*, parish of Linton, the same proprietor. It is conducted on the same plan, and nine men are employed. The strata incline to south-east, at an angle of 15° ; the covering is about 7 feet, with an equal depth of blase or shale and coarse limestone; then 9 feet of excellent limestone resting on shale, under which is a bed of coal 18 inches thick. The

kilns used at both places are of the horse-shoe or old clamp form. Annual sale, 8000 bolls at 1s. 6d.

7. *Carlops Quarry*, parish of Linton, rented by Messrs Thomson and Scott. This rock inclines to south-east, in some places at about 45° , in others at nearly 80° . The covering is 7 feet of soil, with about from 7 to 14 feet of mixed limestone and sandstone. The lime bed is from 6 to 12 feet thick. Nine men are employed at 4d. per boll of lime produced, excluding coals and filling the kilns. This latter operation is performed at 1d. per boll, and the coal is provided by the employers from their own pits. Annual sales, 7000 bolls at 1s. 6d.

8. *Hemperston Quarry*, parish of Borthwick, rented by Mr Wilson. This quarry is on the south bank of the ravine near Arniston, already alluded to, and presents a very singular front of square joints, much like a weather-beaten wall of rude masonry, with dykes of various breadths, all running south and north, or at right angles with the face of the quarry. In the seams are found calcareous spar and stalagmites. The strata incline to the south at about 10° . The covering is 4 feet of soil, and 4 of inferior limestone, over the main beds, which are 10 feet thick, in courses of from 6 to 12 inches each. Six men at 11s. per week, and four horses, are employed. Coal costs 2s. 6d. per cart at the kiln; one cart of coal is allowed to four of limestone, or eighty of stone and twenty-two of coal to each kiln, which, on an average, yields eighty bolls of shells, with a residue which is termed dreg or small lime, and is sold at 10d. per cart. Annual sale, 5500 bolls at 1s. 9d. per boll.

9. *Middleton Quarry*, Borthwick parish, rented by Mr Bain. A fine body of limestone, about 18 feet thick, the lower part very compact, of a deep blue colour, resting on shale; the overlying strata about 5 feet of mixed blase, with five feet of surface soil; dip E., angle of inclination 15° . Ten men at 11s. per week, and eight horses, are employed

Coal costs 2s. per cart, exclusive of carriage, which is about 1s. more. Every 12 carts of stone require 3 of coal; or 90 of stones and 23 of coal to a whole kiln, which will yield about 110 bolls of shells, besides a quantity of dreg, at 1s. 3d. per cart. Annual sales 12,000 bolls, at 1s. 9d.

10. *Blinkbonny Quarry*, parish of Newbattle, rented by Mr Lawrie. This work is situated on the Roman Camp, the property of the Marquis of Lothian. There is a covering of from 5 to 15 feet, chiefly composed of soil, sandstone, and blase, under which are alternate courses of limestone and shale, with a bed of fine limestone at the bottom, from 8 to 15 feet thick. Dip SE., inclination 25°. Eight men and four horses are employed. Quarrying and filling cost 4d. per boll of lime sold, with 3½d. per cubic yard for tiring. Coal costs 1s. 9d. per cart at the kiln; one cart of limestone requires one of coal. Annual sales 5000 bolls, at 1s. 6d. The kilns are all of the horse-shoe form, about 30 feet by 8 at bottom, tapering to 12 at top, and 7 deep. The stones are broken much smaller than is common, and are all placed on end, with a little brushwood under, and coal alternating in layers to the top, which terminates in an obtuse angle, about 3 feet above the walls, and is covered over with mortar when the kiln is ignited, to prevent too rapid combustion. These kilns are preferred by many to the draw kilns, on account of the slow and superior manner in which the stones are calcined; whereas the practice of daily removing a quantity of lime from the draw kiln, either hurries the operation or defeats it, bringing down the limestone before it is thoroughly calcined. The proprietor of this quarry being now engaged in laying down a railway from thence to Edinburgh, the spirited tenant has made arrangements by which the lime is to be slaked, made into mortar, and laid down in town, in any quantity, at a few hours' notice. What a contrast does all this present to the time when lime was regularly conveyed

from this very quarry, to cement the giddy tops of Auld Reekie, on horses' backs and crook saddles !

11. *Crighton Dean Quarry*, parish of Cranston, rented by Mr Bain. The lime rock here is about 14 feet deep, and over it lies a bed of inferior limestone, sandstone, and shale, of equal thickness, which is covered by nearly 20 feet of soil. Dip N., inclination 20°. Forty-five men are employed, at 10s. 6d. per week, and eight horses. Coal costs 1s. per cart at the kiln ; three carts of coal are allowed to twelve of stones. Annual sale 24,000 bolls, at 1s. 9d.

12. *Cousland Quarry*, parish of Cranston, rented by Mrs Dickson. This limestone is from 10 to 12 feet thick, in three successive courses, the lowest being the largest and best. Resting on these is a bed of shale and blue clay, about 14 feet thick, and surmounted by 20 feet of soil. Dip NE., inclination 12°. Twenty men are employed, at 6d. per boll of lime sold, the employer paying the coal only ; 1 boll of coal is computed to 1½ of lime ; the coal is 6d. per boll, or 1s. 3d. per cart at the pit. The stones are drawn along the quarry on rails in one-horse waggons, and thence to the kiln on an inclined plane, by a chain and drum, moved by one horse. Annual sales 16,000 bolls, at 1s. 10d.

Besides these, there are the Mansfield, Dorsiefarm, Turnie-dykes, Vogrie, and some other quarries of small extent in the same district.

In East Lothian or Haddingtonshire, the limestone deposits are of the same general nature.

13. *Salton Quarries*, parish of Salton, rented by Mr Muirhead. This rock has about 4 feet of tiring, then 4 feet of very hard quartz sandstone, generally used for road-metal and rubble buildings. The limestone is about 12 feet in depth, resting on shale. The present front of the quarry is about 600 feet, forming nearly two sides of a square, one side, however, being entirely useless as lime, being a dike, which runs

parallel with the whole side, the tiring of which, and the expense of opening the rock behind it (nearly L. 40), might have been avoided, had the quarriers attended to the fact, that such dikes generally run from south to north, or nearly so. Twenty men and six horses are employed; the lime is prepared at 3½d. per boll, exclusive of coal, and the tiring performed at 3d. per cubic yard; coal cost 1s. 6d. (about 15 cwt.) per cart at the pit, a little way off; one cart of coal prepares nearly 5 bolls of lime. Annual sale 24,000 bolls, at 1s. 10d. per boll, corn-measure.

14. *Jerusalem Quarry*, parish of Pencaitland, rented by Mr Houden. This rock is from 10 to 15 feet deep; in five beds, varying in thickness; the covering is entirely soil, from 10 to 20 feet deep; the dip NW., the inclination 10°. Six men and three horses are employed; tiring costs 3d. per cubic yard, quarrying and filling 2½d. per boll, or 18s. 9d. per 100 bolls; four carts of stones yield 20 bolls of lime-shells, and require three carts of coal, at 1s. 6d. per cart, or 2s. 3d. carriage included. This quarry is well conducted, though without machinery, and is kept level-free by a tunnel. L. 700 have been expended on one kiln, which calcines from 350 to 400 bolls at a time. Annual sale 8000 bolls, at 1s. 10d.

15. *Sunny-side Quarry*, parish of Prestonkirk, rented by Mr Slate. This rock is about 8 feet deep, with an overlying stratum of from 5 to 15 feet of red till and loose soil; dip E., inclination varying from 0° to 30°. The greater part of this quarry is dug with mattocks, crow-bars, and hammers. Eight men and two horses are employed; quarrying and filling cost 3½d. per boll; tiring 3½d. per cubic yard. The coal used is carried ten miles, and costs 5s. 3d. per cart, carriage included; one cart of coal is sufficient for 9 or 10 bolls of shells. Annual sale about 7000 bolls, at 2s.

16. *East Barns*, parish of Dunbar, occupied by the proprietor, R. Hay, Esq. This limestone bed is from 12 to 14 feet thick; the upper ledge, about 1¼ thick, being poor, is re-

moved, with from 5 to 8 feet of covering. Five men, at 10s. per week, and two horses, are employed; 1 cart of coal costs 6s. and suffices for 9 bolls of lime. Annual sales 7000 bolls, at 1s. 6d. pease measure.

17. *Skateraw Quarry*, parish of Innerwick, rented by Mr Brodie. This rock is washed by the tide, and its seaward beds, from 2 to 10 feet thick, can be worked only at low water. It inclines to NE., at an angle of 10°. A fine bed, however, is opened on the land side, 12 feet thick, but with an incumbent mass of nearly 50 feet. Fifteen men and ten horses are employed; quarrying and filling cost 3½d. per boll of lime sold; tiring 4d. per cubic yard. Coal costs 10s. per ton; 1 ton burns 15 bolls of shells. There are three very superior kilns, capable of producing 300, 350, and 550 bolls respectively. Annual sale 18,000 bolls, at 1s. 7d.

18. *Harelaw Quarry*, parish of Gladsmuir, rented by Mr Hercus. This rock is from 12 to 14 feet thick, with a covering of from 7 to 20 feet, of which from 5 to 10 are soil, the rest shale; the inclination 25°. Seven men, at 10s. per week, and five horses are employed; one cart of coal, which costs 1s. 9d., or 3s. 3d. carriage included, is allowed to 7 bolls of lime. Annual sale 8000 bolls, at 1s. 10d.

There are also in this district, Balgonie, Oxwellmains, Gifford, Lampland, Ormiston, and some other minor quarries.

The following lime-works in the West Lothian district have been examined.

19. *East Camps Quarry*, parish of Kirknewton, rented by Mr Stark. This is one of the finest lime rocks in the district, and has long been worked to a considerable extent. The main bed is from 40 to 50 feet thick, with a covering of from 10 to 20 feet of blase or shale, intermixed with nodules of ironstone, then from 12 to 25 feet of earth; dip SW., inclination 25°. Twenty men and two horses are employed; the men work chiefly at 10s. 6d. per week; tiring 6d. per cubic

yard; one cart of coal, about a ton, calcines from 8 to 10 wagons of limestone; the coal is carried 12 miles, and costs 7s. 8d. per cart. This lime, being very white, is much used for cleaning houses, and similar purposes, and admits of four times its bulk of sand in making mortar. The stones are conveyed to the kiln in wagons, drawn on an inclined plane by a chain and drum, moved by a steam-engine, which also removes all the under water. Annual sale 5500 tons, at 10s. per ton, or 2s. 3d. per corn boll. About 2500 tons of limestone also are annually sold to the Shotts Iron-Work, at 1s. 7d. per ton.

20. *Raw Camps Quarry*, parish of Kirknewton, rented by Mr Crawford, and only separated from the last by an ideal line, is in the same deposit, and is worked in the same manner, but to a less extent. Ten men, at 10s. 6d., and two horses are employed; one cart of coal prepares two carts of lime, or about 5 bolls; 12 cwt. of coals are allowed to one cart of lime. Annual sale 3500 tons. at 10s.

21. *Levenscat Quarry*, parish of West Calder, rented by Mr Cunningham. This rock is worked entirely by mining; the principal bed is 7 or 8 feet thick; dip NE., inclination 20°; the main passage is about 250 yards in length, and from 8 to 10 in breadth, with occasional chambers or cross passages, 12 to 15 feet wide, intermediate blocks or wards being left to support the roof, which are again cut out as the space around is piled up with waste. The roof is sandstone and shale, with nodules of ironstone; about 2 feet of the bottom rock, which rests on shale, is left as a cart-way, and taken up as the course is shifted. Ten men, at 11s. per week, and three horses are employed; coal costs 4s. 9d. per ton; 10 tons of coal are allowed to 100 bolls of lime. Annual sale 12,000 bolls, at 2s. 6d. corn measure (nearly 6 bushels).

22. *Gateshiel Quarry*, parish of Bathgate, rented by Mr Paris. This rock varies in thickness from 25 to 35 feet, only a few feet of the lower bed being pure limestone, the rest a mixture of beds of sandstone, shale, and limestone; dip N.,

inclination 45° . Ten men and four horses are employed; quarrying and tiring cost 5d. per boll; great coal is 5s. 4d. per cart at the kiln; one cart burns 6 bolls of lime. Annual sale about 7000 bolls, at 2s. 6d. per boll.

23. *North Silver Mine*, parish of Linlithgow, rented by Mr Aitken. This quarry, which is contiguous with the last, is, like it, a mixture of good and bad limestone. The rock is from 20 to 30 feet deep, and, contrary to most other quarries, the worst lime is at the bottom; the covering is from 10 to 15 feet thick; the strata incline from NW. to NE., at an angle of about 30° ; a dike, 30 or 40 feet wide, and composed of quartzzy sandstone and limestone, intersects the working. Ten men and two horses are employed; the quarrying costs 4d. per boll of shells; tiring 5d. per cubic yard; coal 8d. per load, or 5s. 4d. per cart, carriage included; 1 cart of coal is required for 4 bolls of lime. Annual sale 8000 bolls, at 2s. 6d. The lime used in building Linlithgow Palace is said to have been taken from this quarry.

24. *Duddingston Quarry*, parish of Abercorn, occupied by the proprietor, Major H. Dundas. This once extensive rock is now nearly exhausted, from its low situation and continued inclination, the limestone being about 50 feet under the surface, with only about three feet of overlying rock, which is not sufficient to sustain the roof were mining attempted. The lime bed is about 10 feet thick, and inclines to the north, at an angle of 25° . Twenty men and two horses are employed; tiring costs 5d. per cubic yard; quarrying 21s. 2d. per boll of lime sold, or, if stones are sold unburnt, 2d. per ton; 1 ton of stones yields 3 bolls of lime; coal costs 7s. per ton at the kiln; 1 ton calcines 10 bolls of lime. Annual sale 20,000 bolls, at 2s. All the kilns are of the horse-shoe or oblong form, about 30 by 20 feet at top, 28 by 15 at bottom, and 10 feet deep; each kiln burns from 200 to 300 bolls, and from one to two weeks are sometimes allowed to burn and cool a kiln. Few quarries are better regulated than

this, and it has always yielded a good return, the nett profits of one season lately having been above L. 800.

To these may be added Dundas, Hillhouse, Wardlaw, Carubber, Booden, South Silvermine, Kirkton, Peterhill, and Backstoneford Quarries, which are all of a similar nature.

Forth and Clyde District.

25. In this district perhaps the oldest lime quarry is that of *Murray's-hall*, in the parish of St Ninian's, rented by Mr Lowe. This fine body of limestone is overtopped by a mountain several hundred feet high, with a perpendicular south-west front of huge columns of greenstone, resting on sandstone, under which is shale resting on limestone, the latter based on a bed of sandstone and shale upwards of 30 feet thick, which is supported by a second bed of limestone, and this rests on shale and coal. The lower limestone bed is now worked, and is nearly 6 feet thick. The mine penetrates into the hill upwards of 400 yards, with various cross-paths; the inclination is about 25° to S.E.; the limestone bed diminishes in thickness as it recedes; some splendid specimens of calc spar are occasionally found in the interstices of the rock. The chambers are worked from 18 to 20 feet wide, and wards are left from 8 to 10 feet apart; pit wood is also used to support the roof, when necessary. Twelve men are employed, and two horses; the miners are paid at the rate of 12s. for every pile of stones 8 feet by 4, and 4 feet high, and the kiln men have 2s. per day; one cart of coal burns about 6 bolls of lime, and costs 4s. at the kiln. Annual sales 7500 bolls, at 2s. 4d. pease measure. The workings being uniform with the dip, or at the base of an inclined plane, a pump propelled by a horse is constantly in action, to draw off the water.

26. *Craigend Quarry*, parish of St Ninian's, occupied by the proprietor, W. R. Ramsay, Esq. This mine is very similar to the last, being surmounted by a mass of rock, but a level has been driven at a very considerable expense to the

lowest accessible part of the lime bed, which is thereby worked level-free, or on the ascent of the plane. The strata incline to S.E., at an angle of 12° ; twelve men and two horses are employed, which, together with the price of coal (15 cwt. a cart) and proportion of lime, are on the same terms as at Murray's-hall. Annual sale 4500 bolls, at 2s. 4d.

27. *Cumbernauld Quarry*, parish of Cumbernauld, occupied by the proprietor Admiral Fleming. Here there is a most extensive mine, as well as an open quarry; they are separated by a deep ravine, from which the strata incline to either side. The main passage into the mine is fully 200 yards in length, and has many cross-ways of nearly equal extent. The lime bed is about 7 feet thick, which being removed, with 2 feet of shale, a fine sandstone roof is obtained. About seventy men are employed; the miners furnish the required number of horses, and are paid 1s. 6d. per ton of stones produced on the kiln head; the same sum is paid per ton when any tiring and quarrying occur together; 1 ton of stones produces 12 barley firlots of lime; the coal is laid down at the kiln at 5s. per ton; 1 ton calcines 24 bolls of lime, 2 firlots to the boll. Annual sale 80,000 bolls, at 1s. 2d. per boll; 2000 tons of unburnt stones are also annually sold, at 4s. per ton. A water-wheel raises the mine-water upwards of fifty feet, divided into three elevations by means of shafts working on inclined planes.

28. *Netherwood Quarry*, parish of Cumbernauld, occupied by the proprietor, Mr Williams. In this mine the lime-bed is about 6 feet thick, in two parts, the lower course 2, the upper 4 feet thick; the chambers are in some places nearly 20 feet square; the strata incline N.E. at an angle of 10° . Twenty-five men are employed, at about 17s. for every six waggons of 25 cwt. of stones each, which are conveyed on rails to the kiln; six kiln-men are paid 2s. per day; coal costs 5s. 8d. per ton, laid down; 14 tons of coal prepare 22 chal-

ders of lime,—16 bolls a chalder, 2 firlots a boll. Annual sale 2500 chalders, at 18s. 8d.

29. *Campsie South Quarry*, Campsie parish, rented by Mr Macfarlane. This mine contains about four feet of limestone overlying an equal depth of coal; and both are worked together. Fourteen men are employed, at 1s. 8d. per ton; coal costs 2s. per ton; 1 ton burns 14 bolls of lime, of 2 firlots each. Annual sale 1200 chalders, at 13s. 4d. per chalder.

Besides these, there are in the same district, the North Campsie, Kilpatrick, Glorat, and some other quarries.

Carrick and Cunninghame District.

30. *Hurlst Quarry*, Abbey Parish, Paisley, occupied by Messrs Wilson. This limestone is extensively worked in connection with coal, alum, and copperas, by means of pits and shafts, in some places about 35 fathoms deep. The limestone bed is from 1 to 3 feet thick; under this is a bed of alum shale, which is in some parts 2 feet thick, and at others thinned away, the limestone being thickest where the shale is thinnest; the coal below both is from 5 to 6 feet thick, accompanied by copperas; the strata incline to the east, at an angle of 10°. The limestone is dug by the ton; 3 tons of stones produce a chalder of lime, of 16 bolls, 2 bushels to the boll, and 20 cwt. are sold for 8 bolls, or $\frac{1}{2}$ chalder, at 9d. per boll; 18 cwt. of coal, valued at 3s. 4d. per ton, burn a chalder of lime; the miners have 3s. per chalder of lime, or 1s. per ton of stones. Rails are laid in the mine, and the stones being put into baskets placed on trams, a man pushes them along to the bottom of the shaft, whence they are raised to the surface by a steam-engine. Eight miners are retained for the limestone, and two kiln-men; the latter have 12s. per week. Ten oblong or clamp kilns are used, which produce together 250 chalders of lime. Annual sale 1600 chalders, at 12s.

31. *Househill Quarry*, Abbey Parish, Paisley, rented by Mr Dove. This mine is close to the last, and is exactly simi-

lar, only with a greater depth of shaft and workings. The strata incline to E. at an angle of 15° ; the mode and expense of working the limestone are the same. Annual sale 1400 chalders, at 12s.

32. *Arden Quarry*, parish of Eastwood, rented by Mr Fleming. This singular rock may be designated as perhaps the worst limestone in Scotland with reference to agriculture; yet it is invaluable to the architect, having the property of firmly cohering without sand, even under water, and being therefore used in building quays and in rough-casting walls. One hundred parts yield only 55 of carbonate of lime; the residuum appears to be argillaceous matter. The demand is considerable, but uncertain. It is all slaked, riddled, and barrelled, when sent to a distance. The price is 1s. 6d. per 2 bushels.

33. *Thornton House Quarry*, East Kilbride parish, occupied by the proprietor, H. Smith, Esq. This rock is 10 feet deep, in several beds, with from 15 to 20 feet of covering; the strata incline to the south. Quarrying and carting to the kiln cost 4s. per chalder, of 16 bolls, of lime, 2 bushels to the boll; burning 5d. per chalder, exclusive of coal, which costs 4s. 10d. per cart of 12 cwt.; 16 cwt. of coal burn 1 chalder of lime. Annual sale 1800 chalders, at 13s. 4d.

34. *Brachcad Quarry*, East Kilbride parish, rented by Mr Reid. This is another opening of the same rock; the limestone is from 8 to 10 feet deep; the dip S. W., the inclination very slight; the covering, 2 feet of shale, 4 of clay, and 6 of soil. Twelve men are employed on the same terms as above. Annual sale 3000 chalders, at 13s. 4d.

35. *Cessnock Quarry*, parish of Galston, rented by Mr Parker. This is a very fine mass of rock, but bears marks of injudicious working. The bed is 18 feet thick of clean limestone, with a crust of sandstone, and from 10 to 12 feet of soil; the strata incline to S.E. at an angle of 10° . Ten men, at 2s. per day, and two horses, are employed; coal costs $5\frac{1}{2}$ d. a creel, six creels being a cart, (about 18 cwt.), hire 6d., in all 3s. 3d. per

cart ; 55 creels are allowed to 100 bolls of lime. Annual sale 5000 bolls, of 4 bushels, at 1s. 2d. per boll.

36. *Balgreggan Quarry*, parish of Kirkmichael, occupied by the proprietor, Sir D. H. Blair, Bart. This rock is partly worked as a mine, and partly as a quarry ; the bed is from 7 to 20 feet thick, with nodules of limestone in shale ; 40 feet of shale, sandstone and surface soil over it ; the strata incline to W. at an angle of 30°. Twenty men, at 2s. per day, and two horses, are employed ; coal costs 4s. per cart at the kiln ; five carts of coal calcine 100 bolls, of 2 bushels each. Annual sale 30,000 bolls, at 8d. per boll.

37. *Halton Quarry*, parish of Kirkmichael, occupied by the proprietor, W. Niven, Esq. This quarry is rapidly passing into a spacious mine ; the bed is from 14 to 22 feet thick ; the strata incline NW. at an angle of 25°. Sixteen men, at 2s. per day, and two horses, are employed ; and the whole is conducted on the same plan as the last. Annual sale 24000 bolls, at 8d. per boll.

38. *Craighead Quarry*, parish of Daily, rented by Mr Haldine. This is perhaps the finest specimen of mountain limestone in the south of Scotland ; the workings present a perpendicular front of nearly 120 feet of limestone ; the strata incline slightly to the west. Several feet of trap overlie the limestone ; both of which seem to have the same bearing. Twenty men, at 10s. per week, and two horses, are employed ; the boring is done by the inch, at 10d. per 100 inches ; a good workman will perforate 200 inches in a day ; a cart of coal costs 4s. 8d. at the kiln ; six carts calcine 100 bolls of lime. Annual sale 35,000 bolls at 8d.

39. *Tarmitchell Quarry*, Girvan parish, rented by Mr Macmillan. This rock is very similar to the last ; the strata incline slightly to the west. Ten men, at 10s. per week, and three horses, are employed ; coal costs 5s. per cart at the kiln ; five carts go to prepare 100 bolls of lime. Annual sales 20,000 bolls, at 8d. per boll.

40. *Aldoon Quarry*, parish of Colmonell, rented by Mr Lloss. The rock here is still more gigantic than that of either of the two last, as it is worked in the bed of the Stinchar, 300 feet below the base of the quarry, which has nearly 100 feet of perpendicular front; the strata incline to the west; the rock is conglomerate, and the limestone is chiefly in squares of from 1 to 18 inches, overlapping each other in the most regular manner, and forming lines or oblique joints down the whole sloping face of the quarry, all bearing S W. The quarry, however, seems to have been improperly conducted in regard to the dip of the rock. Ten men, at 11s. per week, and three horses are employed; coal costs 6s. 8d. per cart, including carriage; 6 carts are allowed for 100 bolls of lime. Annual sale 14,000 bolls, at 9d. per boll.

41. *Craigniel Quarry*, Girvan parish, rented by Mr Maclean. This quarry is under the walls of the ancient castle of the same name; the limestone is similar to that of the preceding quarries, and, as at Aldoon, the rock has been opened on the reverse side of the cleavage; the strata incline slightly to SW. Six men, at 12s. per week, and two horses are employed; coal costs 8s. 9d. per cart at the kiln; twelve carts are required for 300 bolls of lime. Annual sale 11,000 bolls, at 11d. per boll.

42. *Gaswater Quarry*, parish of Auchinleck, rented by Mr M'Turk. The limestone is from 7 to 9 feet thick, in four beds, the upper about $1\frac{1}{2}$ thick, partially mixed with shale, and an immense quantity of marine shells, which appear all placed with their orifice under, forming so many knobs or protuberances over the whole ledge. Above this is about one foot of shale, then from four to seven feet of red clay, with rolled pebbles imbedded. But the most singular feature is a bed of pure peat-moss at the top, from 4 to 5 feet thick, full of roots of trees, hazel nuts, and other remains. The quarry is on the summit of a high moor, nearly thirty miles from the sea, and 300 feet above its level. The strata incline to

W. at an angle of 20° . Twenty men, at 12s. per week, and three horses, are employed ; coal is dug a little way off under the same lease, and may cost 1s. per cart ; one cart burns 7 bolls of lime, of 4 bushels each. Annual sale, 12,000 bolls, at 1s. per boll.

43. *Benston Quarry*, parish of New Cumnock, rented by Mr Whitefield. This rock is from 7 to 10 feet thick, with a covering of from 6 to 8 feet of coarse limestone and sandstone mixed, then from 5 to 20 feet of blue clay, with from 3 to 5 feet of moss ; the strata incline to N.E. at an angle of 15° . Forty men, at 12s. per week, and six horses, are employed ; coal costs 2s. 9d. per cart at the kiln ; five carts of coal burn 200 bolls of lime. Annual sale 100,000 bushels, at 3d. per bushel shells, and $4\frac{1}{2}$ d. slaked and riddled.

44. *Craigdullet Quarry*, parish of New Cumnock, occupied by the proprietor, J. S. Menteath, Esq. This rock is in two beds, about 9 feet thick, but from the deep covering and great dip (45°), it is now being mined. The limestone is good, but the locality unfavourable, it being on the summit of a mountain quite detached from the arable district. The working is let at 25s. per 200 bushels of lime sold, the proprietor furnishing the coal, which is raised close by ; one cart of coal burns 50 bushels of lime. Annual sale 20,000 bushels, at 4d.

Contiguous to some of the above are the quarries of Beith, Thornton, Craigie, Sorn, Cargill, Loudon, Netherston, Craighonhill, Carluke, and many others not extensively worked.

• *Nithsdale District.*

45. *Closeburn Quarry*, parish of Closeburn, occupied by the proprietor, J. S. Menteath, Esq. This has long ceased to be worked as an open quarry, and is now a most splendid mine of about 21 feet of limestone in two beds, with six inches of shale interlying. The strata incline to N.E. at an angle of

20'. The roof and bottom are coarse sandstone, and the main passage extends nearly 500 yards in a line, with numerous branches all crossing it at right angles, like so many streets, while the spacious galleries on every side afford ample room for stowing the rubbish. Rails are laid about 200 yards into the mine, and the stones are brought along the diverging alleys in single wagons, containing about one ton, and pushed by a man going behind each till it reaches the main railway, where they are attached to a chain connected with a water wheel of ten-horse power, placed near the entrance of the mine, which drags the team of wagons up an inclined plane to the top of the kilns. The railway is double, and an empty wagon descends as a full one ascends, which forms a counterpoise, and lessens the friction of the machinery. The same wheel also pumps the water from the mine. The mode of working is first to remove the blase from the lime-beds, and then by boring, blasting, and breaking with hammers, to reduce the whole to pieces of moveable size. The clear height of the excavated space is about 24 feet, and columns are left at regular distances, 5 feet in the side, and 30 feet apart. Formerly the columns were upwards of 7 feet in the side; but increasing trade, as well as improved taste, suggested the idea of reducing them to fairer proportions. The upper bed of lime, nearly 7 feet thick, was also left, but is now removed with profit and perfect safety, there being still 2 feet of a solid sandstone for roof. The kilns are of an entirely new construction. Two iron bars, 3 inches in the side, and 5 feet long, are placed, 5 feet from the ground, in the bottom of the kiln, equidistantly dividing the circle of the bottom. Over these other five strong bars are placed, fixed on pivots at one end, and left loose at the other, so that they can be moved nearer to or farther from each other at pleasure. In filling the kiln, the limestone and coals are placed on these bars, and the whole kiln filled up in the usual manner. The fire is then put on a grating about 3 feet

under these bars, and 3 feet are allowed under this for an ash-pit, which keeps the ashes quite separate from the lime. The ashes are sold at 2s. 6d. per cart, for top-dressing land, and held in high estimation for meadows. Shuts are made to fit both ash-pit and furnace, which enables the attendants to temper these at pleasure. The bars also serve to regulate the falling down of the lime, without closing the kiln eye. The other parts of the kilns are equally novel, and may be compared to two cones united at their base, being widest at the centre. The top and bottom diameters are 5 feet, the centre 15, and the depth 33 feet. A blast-pipe has just been added, to hasten the combustion, and is to be supplied with air by a movement from the water-wheel. Forty men are employed, and ten horses; the miners are paid by the superficial yard of roof, at about L. 4 per 110 yards, the gunpowder being furnished by the proprietor. The removal of the shale which separates the limestone beds being the first and most tedious part of the operation, is performed with mattocks or pick-axes, at the rate of L. 12 per 100 yards of roof. The bottom bed, which is six feet thick, costs about L. 6, 10s. per hundred yards. The burners, breakers, and fillers are paid at the rate of 4s. for each 100 measures of two imperial bushels of lime sold. The coal is carted about thirty miles, and costs 13s. 4d. per ton; one ton calcines 45 measures of lime. The six kilns contain about 140 measures each. Annual sale 160,000 measures, at 1s., two bushels to a measure. The water is brought many miles to move the wheel, and irrigates meadows, as well as impels various other machines in its progress. Nor ought it to be omitted to mention that the books are kept in the most accurate and ingenious manner. In short, this is decidedly the best conducted lime-work in Scotland. The penetration and perseverance of the *master* are everywhere apparent and applauded.

46. *Porteston Quarry*, parish of Keir, occupied by the proprietor, Sir W. Jardine, Bart. This rock is from 10 to 13

fect thick, with a covering of from 20 to 30 feet of blue clay, and, in some places, an equal body of sandstone and clay; the strata incline to N. E. at an angle of 25°. Ten men and three horses are employed; quarrying costs 6s. per 100 measures of two bushels, and 5s. more for burning, exclusive of coal. The stones are conveyed in wagons on rails to the kilns, at 1s. 10d. per 100 measures of lime; coal costs 9d. per cwt., and 5d. for hire; 50 cwt. burn 100 measures of lime. Annual sale, 24,000 measures, at 11d.

47. *Bangry Quarry*, parish of Keir, rented by Mr Dodston. This is only a separate working of the same rock as the last. Annual sale, 18,000 measures, at 1s.

There are also quarries at Kelhead, Ecclesfechan, Blackedrig, and Langholm. I have now described the principal quarries south of the Forth and Clyde, and proceed to mention those to the north.

Fife District.

48. *Charleston Quarry*, parish of Dunfermline, occupied by the proprietor, the Earl of Elgin. This quarry has long had the lead in the lime trade, both from its great extent, and its excellent harbour, where vessels can load limestone, lime, coal, and salt, at all seasons. The limestone originally rested on the summit of an abrupt beach of sandstone, but a great many acres have been gone over by the quarry, of which the strata incline to ENE. at a considerable angle, and have a thick covering. The working is performed by boring and blasting, and numerous blocks are often thrown out at an explosion. The quarry is traversed by railways in every direction, by which the limestone is conveyed to the kilns and quays in wagons. The coal is from the proprietor's own pits in the vicinity. More than 200 men are employed, but the manager having declined disclosing particulars, I am of course unable to give them. The price of the limestone is 4s. per ton on board; shells, land sale, 1s. 7d. per four bushels, and

shipped at 1s. 9d. The annual sale may probably average 400,000 bolls, of four bushels, and about 5000 tons of limestone.

49. *Douloch Quarry*, parish of Inverkeithing, occupied by the proprietor, J. Cunningham, Esq. This rock is from 12 to 15 feet thick, with a covering of about 20 feet of shale, sandstone, and soil; the dip SE., the inclination 25°. Fifteen men and three horses are employed; the stones are quarried at 7d. per ton, and the kilns attended at 1½d. per boll of lime sold; coal costs 4½d. per boll, (about 4 cwt.), or 2s. per cart at the kiln; one cart load is sufficient for four bolls of lime. Annual sale, 13,000 bolls, at 1s. 6d.

50. *Inverteil Quarry*, parish of Kinghorn, rented by Mr Kinnenmonth. The rock is 20 feet thick, but with thin beds of shale, inclines to E. at an angle of 25°, and has a covering of from 30 to 40 feet. Ten men, at 10s. per week, and two horses, are employed; coal costs 3s. 6d. per cart at the kiln; one cart of coal calcines 7 bolls of lime. Annual sale, 8000 bolls, at 2s. 2d. barley or corn measure.

51. *Chapel Quarry*, parish of Abbotsford, rented by Mr Beveridge. The limestone, interlaid with beds of shale, is from 25 to 30 feet deep; over it is a bed of very inferior limestone of nearly equal thickness, with a covering of from 5 to 20 feet; the strata incline slightly from the centre to N.E. and S.E. Twenty men and three horses are employed; the stones are quarried and filled, at 5d. per boll of lime sold; coal costs 4s. 2d. per cart at the kiln, one cart burns six bolls of lime. The pit water is removed partly by a two-horse power windmill, and partly by a syphon of 2½ inch pipe, extending 150 yards. Annual sale, 1600 bolls barley or corn measure, at 2s. 1d. per boll.

52. *Forther Quarry*, parish of Kettle, occupied by the proprietor, General Balfour. The limestone is from 15 to 18 feet thick, of inferior quality, surmounted by 8 feet of shale, and 9 inches of coal, then 5 feet of sandstone, 2

feet of inferior limestone, from 6 to 8 feet of shale, and from 15 to 20 feet of soil, or upwards of 60 feet of covering; the strata incline to SE. at an angle of 30°. Thirty men and three horses are employed; the stones are quarried and filled at 3½d. per boll of lime sold; tarring, 4¾d. per cubic yard; the kilnmen have 1d. per boll; coal costs 4s. per cart at the kiln; one cart burns 7 bolls of lime. Annual sale, 18,000 bolls, at 3s. per boll.

53. *Pitlessie Quarry*, parish of Cults, rented by Mr Fennie. This rock is a continuation of the last, and is worked at 8½ per boll of lime, including every outlay but coal, which costs 6s. per cart. Annual sale 12,000 bolls, at 2s. 9d.

54. *Roscobbie Quarry*, parish of Cliesh, rented by Mr Macbean. The limestone is nearly 60 feet thick, 40 feet of it being of excellent quality; there is a covering of from 1 to 5 feet of sandstone, and from 2 to 20 feet of soil; the strata incline to N. at an angle of 30°. Forty men and twelve horses are employed; quarrying costs 8d. per ton; tarring, 5d. per cubic yard; the kiln-men have 12s. per week; coal costs 5s. per ton at the kiln; one ton burns six bolls. Annual sale 25,000 bolls, at 2s. per boll.

Near these are the quarries of Old Pitlessie, Bogie, Glenstone, and some others of small extent.

Angus District.

55. *Hedderwick Quarry*, parish of Montrose, rented by Mr Crawford. This rock is of very considerable thickness, the lowest bed being 16 feet, the other 8 feet in depth; the upper bed is intermixed with red sandstone, and over it are twenty feet of hard red clay, containing rolled pebbles of quartz. A dike, 12 feet broad, intersects the line of working, and causes a shift of 16 feet perpendicular; the strata incline to NE., at a small angle; a portion of the dike is quite friable, and contains about seventy per cent. of pure lime, so that it might be advantageously applied to land

in its present state. Ten men and three horses are employed; quarrying costs 4d. per boll of lime sold; tiring 5d. per cubic yard; coal 12s. at the kiln; one ton of coal burns eight bolls of lime. Annual sale 8000 bolls, of four bushels, at 2s. 11d.

56. *Limefield Quarry*, parish of Brechin, occupied by the proprietor, Mr Guthrie. This rock is in beds of from 2 to 3 feet, alternating with beds of red sandstone, having balls of quartz of all sizes and colours interspersed; the strata incline to N. at an angle of 35° . Seven men, at 9s. per week, and two horses, are employed; coal costs 15s. per ton at the kiln: one ton calcines 12 bolls of lime. Annual sale 3000 bolls, at 3s. per boll.

57. *West Pittendriech Quarry*, parish of Brechin, rented by Mr Scott. This work is a counterpart of the last, only the quarry is more extensive. The strata incline to SW. at an angle of 35° , and to NE. at 45° . Ten men, at 9s. per week, and three horses, are employed; each boll of lime is computed to cost 1s. for coal. Annual sale 3400 bolls, at 3s.

East Pittendriech, Meisondieu, Strickathrow, Boddan, Airley, and some others are omitted, on account of their comparative unimportance.

The lime quarries of the south-west Highlands are of limited operation. At Lismore, Ardnamurchan, and Broadford in Skye, there are quarries of good limestone, which are occasionally worked to some extent; but from the absurd practice of slaking and harping the lime, its qualities are deteriorated. One of the best and most extensive deposits of limestone in Scotland is at Durnie, on the west coast of Sutherland; but though of easy access, it is little used.

The above are the principal lime-quarries in Scotland. In machinery they are in general greatly deficient. Where no level can be obtained, and where windmills are disliked, and horse-pumps are inconvenient, syphons, which can be made to any

bore, and are capable of raising water to any height required, might be employed. Yet only one of these instruments was noticed in all these quarries. The difference of measure employed is productive of much inconvenience, for no two districts agree in this respect, one using the barley firloft, another the wheat, another the imperial bushel; while in one place two firlofts, and two bushels in another, are termed a boll, as if bushels, bolls, and quarters were synonymous, or aliquots of each other.

The advantages that might be derived from these limestone beds to agriculture are immense. How many extensive flats are there in the Lothians, in Stirlingshire, in the centre of Lanarkshire, the south-east of Ayr, and Renfrew, which, although they possess the means of improvement within themselves, are suffered to lie waste. But the limestone rocks are not confined to the coal districts; they pervade almost every part of the country from Tweed to Cape Rath, although in the rugged glens of the north they are as yet little appreciated. But as so much space has already been occupied, I shall conclude with a table shewing the amount of sales at fifty-seven of the principal limestone quarries, last season. Assuming that the smaller works produced a quantity equal to that portion of the above which may have been used by architects and artists of every grade;—or, not to stint this point, let ten per cent. be added to this quantity, to cover the supposed difference; the total then is, in round numbers, 5,060,000 bushels of lime, at $4\frac{1}{2}$ d., applied to the purposes of agriculture. This, at the rate of 120 bushels to the imperial acre, gives 42,166 acres manured with lime in 1833. If we contrast this with the quantity given by Sir John Sinclair for 1814, viz. 12,000,000 bushels, $7\frac{1}{2}$ d. each, at 120 bushels per acre; what a striking picture have we of what the lapse of twenty years has produced, though in the inverse ratio of what the Right Honourable Baronet must have anticipated at the period of his calculations. It, however, strongly enforces the necessity of redoubled exertion, to meet the change with courage.

COMPARATIVE VIEW OF THE LIMESTONE QUARRIES above described.

No.	NAME.	Annual Produce.	Sale Price.	Imperial Bushels.	Price ^{per} Bushel.	Carbonate of Lime in 100 Parts.	No.	NAME.	Annual Produce.	Sale Price.	Imperial Bushels.	Price ^{per} Bushel.	Carbonate of Lime in 100 Parts.
1.	Burdiehouse, . .	15,000	2/3 P. B.	59,640	6½d.	99.7	30.	Hurlet, . . .	1,600	12/ Q. ½	51,200	4½d.	99.8
2.	Mount Lothian, .	15,000	1/8 B. B.	87,120	3½d.	98.9	31.	Houshill, . .	1,400	12/ P. Ch.	44,800	4½d.	99.5
3.	Fullarton, . . .	8,000	1/3 . . .	46,464	3½d.	99.0	32.	Arden, . . .	.....	9d. P. bus.	...	9d.	55.0
4.	Side,	12,000	1/3 . . .	69,696	3½d.	99.5	33.	Thornton, . .	1,800	13/4 Ch.	57,600	5d.	99.0
5.	Bents,	6,000	1/4 . . .	34,848	2½d.	99.0	34.	Brachhead, . .	3,000	13/4 . . .	96,000	5d.	99.5
6.	Whitefield, . . .	8,000	1/6 . . .	46,464	3d.	98.9	35.	Cessnock, . . .	5,000	1/2 Im. ½	20,000	3½d.	99.7
7.	Carlops,	7,000	1/6 . . .	40,656	3d.	99.0	36.	Balgarggan, . .	30,000	8d. 2 Bus.	60,000	4d.	99.5
8.	Hemperton, . . .	5,500	1/9 . . .	31,944	3½d.	99.0	37.	Halton, . . .	24,000	4d. P. B.	48,000	4d.	99.4
9.	Middleton, . . .	12,000	1/9 . . .	69,696	3½d.	94.5	38.	Craighead, . .	35,000	8d. 2 B.	70,000	4d.	99.8
10.	Blinkbonny, . .	5,000	1/6 . . .	29,040	3d.	99.5	39.	Tarmitchell, .	20,000	8d. . . .	40,000	4d.	99.5
11.	Crichtondean, .	24,000	1/9 . . .	130,392	3½d.	96.8	40.	Aldon,	14,000	9d. . . .	28,000	4½d.	98.3
12.	Cousland, . . .	16,000	1/10 . . .	92,928	3½d.	98.8	41.	Craignietl, . .	11,000	11d. . .	22,000	5½d.	95.5
13.	Salton,	24,000	1/10 . . .	130,392	3½d.	97.5	42.	Gaswater, . .	12,000	1/ . . .	48,000	6d.	99.0
14.	Jerusalem, . . .	8,000	1/10 . . .	46,464	3½d.	98.0	43.	Benston, . . .	100,000	3d. to 4½d.	100,000	3d.-4½	99.2
15.	Sunnyside, . . .	7,000	2/	40,656	4d.	96.0	44.	Craigduillet, .	20,000	4d. . . .	20,000	4d.	97.5
16.	East Barns, . . .	7,000	1/6 P. B.	27,832	4½d.	99.0	45.	Closeburn, . .	160,000	1/2 Bus.	320,000	6d.	99.9
17.	Skateraw, . . .	18,000	1/7 . . .	71,868	4½d.	99.0	46.	Porteston, . .	24,000	11d. . .	48,000	5½d.	99.0
18.	Harelaw,	8,000	1/10 B. B.	46,464	3½d.	97.7	47.	Bangry,	18,000	1/ . . .	36,000	6d.	99.3
19.	East Camps, . .	5,500	6d. cwt.	106,484	4½d.	99.7	48.	Charleston, . .	400,000	1/7 4 B.	1,600,000	4½d.	96.5
20.	Raw Camps, . . .	3,500	10/ P. ton.	93,336	4½d.	99.7	49.	Douloch, . . .	13,000	1/6 . . .	52,000	4½d.	99.5
21.	Leven Seat, . . .	12,000	2/6 B. B.	69,696	5d.	99.0	50.	Inveriel, . . .	8,000	2/2 B. M.	46,848	4½d.	97.0
22.	Gatheshill, . . .	7,000	2/6 . . .	40,656	5d.	98.5	51.	Chapel,	16,000	2/1 . . .	93,076	4d.	99.5
23.	North Silvermine,	8,000	2/6 . . .	46,464	5d.	99.2	52.	Forther, . . .	18,000	3/ . . .	105,408	6d.	99.7
24.	Duddingston, . .	20,000	2/ . . .	116,160	4d.	99.7	53.	Pitlessie, . . .	12,000	2/9 . . .	70,272	5½d.	99.5
25.	Murrayshall, . .	7,500	2 4 P. B.	29,820	7d.	99.0	54.	Roscobbie, . .	25,000	2/ . . .	146,470	4d.	98.5
26.	Craigend,	4,500	2 4 . . .	17,892	7d.	99.0	55.	Hedderwick, .	8,000	2 11 4 B.	32,000	8½d.	99.0
27.	Cumbernauld, . .	80,000	1/2 B. ½	245,440	4½d.	99.5	56.	Limefield, . .	3,000	3/ B. M.	18,024	6d.	99.0
28.	Netherwood, . .	2,500	18/8 Ch.	122,720	4½d.	99.3	57.	West Pittendreich,	3,400	3/ . . .	20,424	6d.	99.7
29.	Campsie So. . . .	1,200	13/4 . . .	55,998	4d.	98.5							

REPORT OF EXPERIMENTS ON THE COMPARATIVE VALUE OF
DIFFERENT VARIETIES OF THE POTATO. *By Mr ANDREW
HOWDEN, Lawhead, East Lothian.*

[In 1832, the Society offered a premium for the best descriptive account, founded on actual experiment, of the different varieties of the Potato best adapted for field culture. It was required that the report should detail the names, general characters, productiveness, keeping properties, and mode of cultivation of the different kinds. The premium has been adjudged to Mr Howden, whose report, with the accompanying tables, is here published.]

HAVING observed, upwards of three years ago, a premium offered by the Highland Society of Scotland for the most satisfactory descriptive account of the different varieties of the potato, I resolved to become a competitor. I therefore set about collecting as many varieties as I could, and, by the kind assistance of my friends from England, Ireland, Holland, &c. I was soon put in possession of a considerable number. Many of them, however, I did not grow after the first year's trial, as I considered them unworthy. In this, and in the second year, I found what I did not expect,—that several kinds newly raised from seed became completely curled.

In the outset, I had the promise of a friend that he would take management of the early kinds in the garden, but after the first year he could not be induced to give the experiment the attention necessary; I therefore resolved to continue the growth of both the early and late varieties in the field, and, for three successive years, I have used my best endeavours, with a view to discover which varieties of the potato are the best deserving of the farmer's attention. Such as have been used to conduct experiments of this kind only can judge of the care and trouble which the experimenter has to encounter, and, my hopes of success not being very sanguine, after a second year, I believe I should have stopped, but for a sense of what I owed to the Highland Society for former marks of

attention. I felt that, during this time, the public were put in possession of several excellent papers upon the potato, and that those from the pens of Mr Knight, Sir George M'Kenzie, and the more practical, but not less useful production of Mr Lawson, would excite an interest far beyond what a dry detail of facts by me could produce. Here some of my friends, who had noticed my proceedings, urged me on, and I shall now endeavour to give an account of the manner in which the experiment was conducted.

In spring 1832, I set apart two ridges, each sixteen feet wide; to these I applied decomposed farm-yard dung, at the rate of sixteen tons per acre, spread over the surface, and ploughed it in deep. The second week of May 100 potatoes of each variety were selected and planted whole, with the spade, across the ridges, in three rows, at a distance of twenty-seven inches from each other. The crop was kept clean and earthed up with the hand-hoe, and the whole taken up in the second week of October, each lot being correctly weighed, numbered, and put into separate pits. Crops 1833 and 1834 were managed exactly in the same way, with this difference, that crop 1834 was planted the last week of April, and the early varieties were taken up on the 14th October. I ought here to mention, that every variety, the leaf of which was withered, and the skin hardened upon the tubers, at this time was held to be early; but such other varieties as had the leaf still fresh were accounted late, and allowed to stand a fortnight longer. Mr Lawson was now so obliging as to send me bags, which enabled me to forward to a friend of mine (Mr Dudgeon, who carries on an extensive potato-flour manufactory), sixty-four varieties to be made into flour. Without the assistance of Mr Dudgeon, I scarcely think that this part of the experiment would have been accurately made, but with his kind help I am satisfied the thing has been correctly done, although the very great difference, as stated betwixt one kind and another, makes him distrust the people who extracted the flour. It will be understood that, in each of the respective years, all the varieties have been grown under the same cir-

circumstances as to soil, manure, and culture ; and, in the two last years, from tubers produced under the same circumstances the previous season. This is a particular which I think indispensable in determining the value of the different varieties ; but even where we observe this, we have still much to learn, because different varieties are more or less adapted to different soils and climates. This I found to be the case with several varieties which I had planted in 1833, upon the top of Traprain Law, upwards of 700 feet above sea level, and upon the farms of Johnseleugh and Mayshiel, perhaps at double the height, being about the highest cultivated land in Lammermuir. To Mr Renwick, the farmer at Mayshiel, I feel much indebted for the trouble which he took. From the attention he gives, many others besides me are benefited by the superior seed potatoes which his farm produces. The land with me, where the experiment has been conducted, is not more than an hundred feet above the sea, and all the three several fields are free soil, and suited to the growth of the potato,—the best of the three produced crop 1834. Seeing that the rule of competition requires that at least four bushels of each variety shall be grown, I selected some of the most productive varieties, and with them I planted forty drills, twenty-seven inches wide and 120 yards long. The kind and quantity of manure applied was here given at the same rate per acre as upon what was put in with the spade ; each variety occupied one drill, and whole potatoes were planted. The seed was covered by the plough, and at a proper time the crop was earthed up by the same implement,—a single mould-board plough, as I consider that a double mould, by its wedge-like form, consolidates the land too much. The result tends to shew, that it is not profitable to substitute spade labour in the field, as it would seem that the work can be executed in a manner sufficiently perfect by the plough in the production of a crop of potatoes. All the kinds under the experiment were allowed to blossom and produce apples, as nature prompted. In other years I have practised pulling off the blossoms, and the effect seems to me to depend very much upon the na-

ure of the season. In years when the apples are plentiful, I have seen a difference of nearly a sixth gained by pulling off the blossoms, whereas in other seasons the difference was a mere trifle.

In 1832 I had ten sacks, each containing a different variety of the potato, sent from Ireland. With part of their produce I planted, in 1833, 900 yards upon one drill with whole potatoes, and the same extent with the same varieties cut. The whole potatoes were placed in the drills eighteen inches apart, and the cut at twelve inches. When taken up and weighed, the produce from the whole potatoes exceeded the others by 811 pounds, but I found more small tubers in what was produced from the whole potatoes. To determine the flavour of the different kinds is, in some measure, but guess work. I had only five varieties cooked daily in succession. Some kinds burst before others are sufficiently boiled. The proper season for using most of the early kinds was past, whereas those which are late had not ripened their flavour.

I am farther of opinion, that the same weight of the same kinds of potatoes will give a higher extract of starch at one period of the season than another; for these reasons I fear I may have contributed but little towards the advancement of the object which the Society has in view. This point the table now submitted for consideration must determine. For myself, I look upon it as merely resolving with something like certainty the comparative weights per acre of the raw material of the different varieties, and only useful so far.

The impression which the experiment has left with me is this,—that the lumpers and the cups are valuable, and safe to grow for cattle, because they cover the ground well in, do not curl, and produce great weights. I state this upon nearly twenty years' experience. I shall continue to grow the Wellington and a few others, the weights of which stand high in the table. In the fall of the year, for family use I should prefer the white and blue Dons, and in spring the old rough black and Irish apple. Through summer, after the ash leaf, I would recommend what I have named Dudgeon's black

early and the Flamingo or red early, none of which seem liable to disease. It is long since the doctrine was promulgated, that when the potato has communicated to the apple the power of reproduction, then the tubers lose that power in a certain degree, nature thereby putting a check upon too great an extension of the species. Accordingly, we find in seasons when the apples are completely ripened, and more especially with those varieties which produce numerous apples, that, from planting the tubers of such, we are almost certain to have diseased plants, and, consequently, an unproductive crop.

I now conclude what more immediately concerns the object originally sought for by your Society, by shortly explaining that, as the varieties marked in the table as from Mr Lawson have only been grown by me for one year, therefore the produce from them cannot be fairly compared with the average of the others, which is taken for the three years. Since, however, another very interesting question has arisen regarding this invaluable esculent (I allude to the cause of the failure of the potato crop in these last two seasons), many conjectures have been hazarded upon this matter, and, amongst the rest, I have been nursing up an opinion, which I shall now venture to lay before your Society. Having previously conceived the idea, that the very dry state of the earth at the time the potatoes were planted was the main cause of the failure, I paid particular attention to the appearance of the potato crop throughout a journey which I made across a large portion of England and part of Ireland, in the month of July 1833, and I observed uniformly, that the failure in the early and low districts had taken place to a greater extent than in higher and late districts. Observing that the evil promised to be even greater in 1834, on the 28th of June last I selected, from a store which had been repeatedly turned and kept for family use, seventy potatoes of the old rough black variety. I divided this number into five lots, sizing them so that each fourteen potatoes weighed exactly four pounds. On the day mentioned, I made fourteen of the number into starch, and, at the same time, I put fourteen others whole, and fourteen cut, into

fifty-six pieces, into a deep box filled with dry mould. The remainder, fourteen whole and fourteen cut, in like manner I put into another box filled with moist earth, and which I watered from time to time. At the end of three weeks, with the exception of five of the sets in this box, all the plants had made their appearance. All this while the dry box had been kept from moisture. I, however, now, on the 21st July, allowed it to be moistened by a heavy rain, and, on the 28th July, I took up and extracted the starch from the whole. Before doing so, however, I weighed the several lots, and, what to me seemed curious, I found that each lot of the whole potatoes had gained eight ounces; while each lot of those which were cut lost six ounces of its weight, and of their number ten did not vegetate. The sprouts from the whole potatoes weighed four ounces, and from the cuts only two ounces; yet the starch from the twenty-eight potatoes cut was only two ounces, that from the twenty-eight whole potatoes planted in the earth was nine ounces, being exactly one-half of the produce of the fourteen from which the starch had been extracted, the day the others were put in the earth, their produce being nine ounces from the fourteen. Again, at this time I put into a basket of dry sea sand, within the house, two whole potatoes, and two others cut into pieces. After seven weeks, the cuts had lost the whole of their substance, which had been taken away by something like capillary attraction, and absorbed by the sand; but one of the whole potatoes, when put into moist earth, germinated freely, and I have it now under cover a healthy plant. I shall here adduce one or two instances which I have noticed in the field, confirmatory of the droughts being the chief cause of the evil. Upon the farm of Traprain, which I possess, I plant a few acres of potatoes for my cattle. This year I had the potato seed cut for a week before it was planted; when planted, the mode of proceeding was by the plough's opening the drills as they went, and the manure being spread, and the seed put in, it was covered as they returned. With this management, I secured a good braird and a good crop, but when what concerned me was completed, as

much of the land was ridged up, and the manure spread upon the several lots, as sufficed for my married servants ; these lying exposed to the sun and wind until the afternoon. The foreman now found that he was in want of as much seed as would plant about twenty-five yards of his lot ; part of what remained of my store he took for this purpose, and upon all this space there did not grow a dozen of plants, yet he had a tolerable crop from tubers which he brought from the high country. Another instance, which I shall mention, took place upon the farm of Lawhead, where I live. Upon the same field of sixteen acres, where the experiment was made, I ridged up forty drills a-week before the rest of the field, and for that time these lay open ; the consequence was, that they were miserably blanky, and did not yield half a crop, while the produce from the rest of the field was unusually abundant.

The inference which I draw from what has been stated is this :—that our mild winters and early springs had, by sprouting, so far exhausted the germinating powers of the potato before it was put in the dry earth, and that, when put in, what of their farinaceous matter remained was drawn from them and absorbed by the soil. That the germinating principle may be destroyed by other causes, I readily allow. Excess of moisture is, perhaps, even more destructive, and if taken up green, or if cut and heaped together in large masses, this effect is often produced ; but, in the two last years, some powerful and uncommon agent of nature seemed to be at work. As a proof that the grand source of the evil lay in the condition of the soil more than in the seed, I have not been informed of any case of failure where the seed was put in after the plough, without the land being ridged, although this perhaps may have occurred where the land was excessively dry, or where the surface was not smoothed after planting by the harrow.

In prosecuting the experiment upon which I have reported, several instances of the advantage of planting whole potatoes occurred, and I can confidently recommend the practice where seed from a late district cannot readily be procured.

TABLE I.—LIST OF SPECIMENS OF EARLY POTATOES, WITH THEIR CHARACTER.

No.	POPULAR NAMES.	Form of the tuber.	Colour.	Waxy or Mealy.	Liable to, or free from, Disease.	Stems.	Flavour.	Produce on 96 ft., 1834.			Average Produce per Acre.		Starch per 32 lb.		Starch per 32 lb. per Acre.
								1832.	1833.	1834.	lb.	bush.	lb.	oz.	
1	Poisie's	Oblong	White	Waxy	Not liable	Weak	Not good	107	108	116	22,250				
2	Williamson's	Oblong	Pink	Dry	Not liable	Strong	Goodish	87	94	170	23,595	341	2	3	1843
3	Black Seedling	Round	Dark red	Dry	Not liable	Weak	Goodish	137	85	136	22,065	348	2	2	1848
4	Howden of Uxton	Round	Pink	Dry	Liable	Weak	Goodish	78	74	81	15,662	226			
5	Round Red	Round	Pink	Mealy	Not liable	Very good	Very good	91	77	114	19,628	284	2	0	1325
6	Fife Blues	Round	Dark red	Dry	Liable	Weak	Good	90	75	50	14,116	204			
7	Fife Whites	Round	Pink & white	Waxy	Liable	Strong	Middling	99	83	121	20,368	295			
8	Round Red	Round	Red	Waxy	Liable	Weak	Very good	123	74	79	18,553	268			
9	Bufs	Round	Pink & white	Mealy	Liable	Weak	Very good	71	79	60	14,116	204			
10	Red Early	Round	White	Mealy	Not liable	Weak	Very good	27	65	131	14,923	216			
11	Shaw's	Round	White	Dry	Not liable	Weak	Goodish	57	115	104	18,553	268	3	2	1665
12	Ash Leaf	Round	White	Dry	Not liable	Weak	Goodish	69	88	105	17,612	255	2	3	1449
13	White Kidney	Round	White	Dry	Not liable	Weak	Goodish	98	49	44	12,639	186	2	14	1808
14	Late Red Kidney	Oblong	Red	Dry	Very liable	Weak	Indifferent	75	79	74	15,326	222			
15	Red Parigatte	Round	Red & white	Mealy	Free	Weak	Good	69	90	51	14,116	204			
16	Aberdeen Kidney	Round	White	Waxy	Liable	Very weak	Good	32	41	31	6,991	101			
17	Lord Lauderdale's Kidney	Long	Red	Dry	Not liable	Weak	Good	80	75	93	16,671	241			
18	Onion	Oblong	Red	Dry	Not liable	Strong	Very good	82	81	92	17,141	248	2	10	1606
19	Eye Pale Red	Oblong	Red	Dry	Not liable	Very strong	Very good	94	93	166	21,712	314	2	10	2035
20	Witchfield	Oblong	Red	Dry	Not liable	Strong	Good	102	112	147	24,267	351	3	4	2316
21	Rock's	Oblong	Reddish	Waxy	Free	Weak	Coarse	62	85	113	17,477	253			
22	Dunlop's Red	Round	Red	Mealy	Liable	Weak	Good	109	102	21,275	338				
23	Peterson's	Round	White	Dry	Not liable	Strong	Goodish	90	90	163	23,075	354	2	0	1644
24	Quebec Profit	Round	White	Waxy	Not liable	Strong	Bad	46	89	131	17,992	212			
25	Calico	Round	Pink & white	Dry	Liable	Weak	Goodish	88	99	81	18,015	261			
26	Edinburgh White Dons	Round	Pine & white	Dry	Liable	Weak	Indifferent	106	104	79	19,427	281			
27	Millar's Thumb	Oblong	Red	Mealy	Not liable	Strong	Good	47	58	97	13,578	196			
28	White Kidney	Long	White	Dry	Liable	Very weak	Goodish	35	27	46	7,260	105			
29	Dickson's White	Round	White	Waxy	liable	Weak	Bad	87	114	19,965	289				
30	Dickson's White	Round	White	Waxy	Very liable	Weak	Indifferent	65	71	13,713	198				
31	Dickson's White	Round	White	Dry	Not liable	Strong	Indifferent	90	151	24,267	351		2	2	1814

TABLE OF LATE POTATOES—continued.

Nos.	POPULAR NAMES.	Form of Tuber.	Colour.	Waxy or Mealy.	Liable to, or free from, Disease.	Stems.	Flavour.	Produce on 36 ft., 1832, 1833, 1834.			Average produce per acre.		Starch per 20 lb. per acre.		Starch lb. per acre.
								lb.	lb.	lb.	lb.	lb.	lb.	oz.	
63	Shetland Dons	Round	Reddish	Mealy	Not liable	Strong	Good	124	96	23,695	343	1	14	1586	
64	Shetland Black	Oblong	Red	Mealy	Not liable	Weak	Very fine	43	139	19,464	287	3	10	2571	
65	Rose Hearty	Oblong	Red	Mealy	Liable	Weak	Good		107	23,494	340	3	8	2811	
66	Ferne's Red Seedling	Round	Pink & white	Waxy	Not liable	Weak	Bad		74	18,755	271				
67	Ferne's Black Seedling	Round	Black	Waxy	Not liable	Weak	Bad		43	13,915	201				
68	Wild	Oblong	Pink	Waxy	Not liable	Strong	Bad		124	30,922	448	2	2	2346	
69	Blue Horn	Oblong	Blue	Dry	Not liable	Weak	Good		203	11,293	363				
70	Gamekeeper's Round White	Round	White	Dry	Not liable	Strong	Good		59	29,443	426				
71	Dudgeon's Black	Oblong	Blue	Mealy	Not liable	Strong	Very good		142	28,636	415				
72	White Seedling	Round	White	Mealy	Not liable	Weak	Good		91	18,351	266				
73	White Seedling, 2d.	Round	White	Mealy	Not liable	Weak	Good		144	29,040	416	1	12	1273	
74	Irish Rough Black	Round	Black	Mealy	Not liable	Weak	Good	102	95	19,864	286				
MR LAWSON'S EARLY VARIETIES.															
75	Early Globe	Round	White	Waxy	Liable	Weak	Bad		38	7,663	111				
76	Early Dwarf	Oblong	White	Dry	Not liable	Weak	Good		82	16,536	239				
77	Ash Leaf	Oblong	White	Waxy	Not liable	Strong	Inferior		98	19,763	286				
78	Hopetoun	Round	White	Mealy	Not liable	Weak	Good		94	18,956	274				
79	London Particular	Round	White	Dry	Not liable	Weak	Good		58	11,696	169				
80	London Long Red Kidney	Curved	Pink	Mealy	Not liable	Weak	Good		46	9,276	134				
81	Early Champion	Round	White	Mealy	Not liable	Weak	Good		118	23,776	344				
82	New Elm-Leaved	Oblong	White	Waxy	Not liable	Weak	Indifferent		56	11,293	163				
83	Seek no Farther	Oblong	Red	Mealy	Not liable	Weak	Good		154	31,056	450				
84	Poor Man's Profit	Round	White	Mealy	Not liable	Weak	Superior		126	25,410	368				
85	Taylor's Fortyfold	Oblong	Red & white	Mealy	Not liable	Weak	Very good		78	15,730	227				
86	Perthshire Red	Oblong	Pink	Waxy	Not liable	Weak	Good		80	16,133	233				
87	Late Champion	Round	White	Dry	Not liable	Weak	Good		86	17,343	251				
88	Red Yam (should be late)	Oblong	White	Waxy	Not liable	Strong	Indifferent		108	21,780	315				
89	Red Kidney	Oblong	Pink	Waxy	Not liable	Weak	Good		62	12,503	181				
90	White Kidney	Oblong	White	Waxy	Liable	Weak	Very good		58	11,696	169				

TABLE III.—LIST OF SPECIMENS OF LATE POTATOES, WITH THEIR CHARACTER.

Nos.	Popular Names.	Form of Tuber.	Colour.	Waxy or Mealy.	Liable to or free from Disease.	Stems.	Flavour.	Produce on 46 feet.		Average produce per acre.		Starch per 25 lb.		Starch per acre.
								1892.	1893.	lb.	oz.	lb.	bush.	
1	Ferre's Blue Seedling.	Oblong	Blue	Waxy	Not liable	Weak	Good	128	66	12,905	185	2	1028	
2	White	Oblong	White	Waxy	Not liable	Strong	Indifferent	73	73	25,813	374	2	2535	
3	New American.	Oblong	White	Dry	Liable	Weak	Good	84	83	20,973	303	2	1685	
4	Smooth-eyed White	Oblong	White	Waxy	Not liable	Weak	Indifferent	78	81	21,040	304	3	2630	
5	Peruvian	Oblong	White	Dry	Not liable	Weak	Goodish	63	103	20,301	294	3	0	2175
6	Blue	Oblong	Blue	Mealy	Not liable	Weak	Good	122	60	16,200	250	2	1229	
7	Dickson's White Kidney	Oblong	White	Dry	Not liable	Weak	Very good	101	110	21,275	308	3	4	2469
8	Lumpers	Oblong	White	Waxy	Not liable	Strong	Bad	142	126	29,107	421	3	0	3118
9	Red and White	Round	Reddish	Dry	Not liable	Strong	Indifferent	114	104	26,149	335	3	10	2993
10	Irish Apple	Round	Red	Mealy	Not liable	Weak	Very good	85	106	21,443	313	3	2	2747
11	Barbados Kidney	Oblong	White	Waxy	Not liable	Weak	Goodish	81	116	21,981	318	3	0	2893
12	London White Breadfruit	Oblong	White	Waxy	Not liable	Strong	Bad	121	129	27,426	397	3	4	3163
13	London Red Breadfruit	Oblong	Red	Waxy	Not liable	Strong	Goodish	118	124	26,321	398	3	6	2942
14	Wales	Oblong	White	Waxy	Not liable	Strong	Coarse	114	117	26,709	387	3	2	2980
15	Lark	Oblong	White	Dry	Not liable	Strong	Coarse	116	127	26,413	382	3	0	2830
16	Large Castle	Oblong	White	Waxy	Not liable	Strong	Coarse	106	125	25,380	378	3	4	3004
17	Wellington or Provost	Oblong	Red	Waxy	Not liable	Strong	Goodish	109	137	27,030	391	3	10	2584
18	Breadfruit	Oblong	White	Waxy	Not liable	Weak	Coarse	73	129	23,031	346	3	4	2777
19	Lord Lauderdale	Oblong	White	Mealy	Not liable	Weak	Coarse	80	84	17,612	255	2	10	1695
20	Late Red Kidney	Oblong	Red	Mealy	Not liable	Strong	Good	75	93	18,620	269	3	8	2076
21	Entire Black	Round	Black	Waxy	Very liable	Strong	Indifferent	25	112	13,953	274	3	4	2269
22	White Kidney	Oblong	White	Dry	Liable	Weak	Good	35	33	10,822	156	3	8	1256
23	French Potato	Oblong	Red	Waxy	Not liable	Strong	Indifferent	68	101	19,335	274	3	4	3735
24	Sawyer's Red	Oblong	Red	Waxy	Not liable	Strong	Bad	121	91	16,292	279	3	0	2067
25	London Blue	Round	Blue	Waxy	Not liable	Weak	Good	121	91	16,292	279	3	0	2067
26	Large Jersey	Oblong	Reddish	Dry	Liable	Weak	Indifferent	94	117	26,149	379	4	0	3735
27	Sanderson's Dunbar	Round	White	Mealy	Not liable	Strong	Very fine	112	112	27,493	398	3	0	3191
28	Red Roses	Round	Red	Mealy	Not liable	Strong	Good	113	131	26,620	385	3	2	2970
29	Cups	Oblong	Red	Mealy	Not liable	Very strong	Good	146	136	33,073	479	3	3	3539
30	Old Rough Black	Round	Black	Mealy	Not liable	Weak	Good	124	93	20,368	295	3	2	2970
31	Farmer	Round	Red	Mealy	Not liable	Weak	Very good	95	91	22,335	324	3	6	2698
32	Gamekeeper's Red Kidney	Oblong	Pink	Dry	Not liable	Strong	Good	132	147	26,620	385	3	3	3000
33	Gamekeeper's White Kidney	Oblong	White	Dry	Not liable	Strong	Good	104	104	23,973	303	3	6	2900
34	Hanoverian	Oblong	White	Waxy	Not liable	Strong	Good	71	71	14,318	207			
MR. LAWSON'S LATE VARIETIES.														
35	Esselback	Oblong	Red	Dry	Not liable	Strong	Good	50	50	10,083	146			
36	Lancashire Pink	Round	Pink	Waxy	Not liable	Strong	Indifferent	170	170	34,293	496			
37	Albany Kidney	Oblong	White	Mealy	Not liable	Strong	Very good	114	114	22,990	333			
38	Breadfruit	Oblong	White	Mealy	Not liable	Strong	Good	152	152	30,653	444			
39	Stafford Hall	Oblong	Red	Mealy	Not liable	Strong	Good	136	136	31,863	461			
40	Connaught Cups	Oblong	Pink	Mealy	Not liable	Strong	Good	140	140	28,233	409			

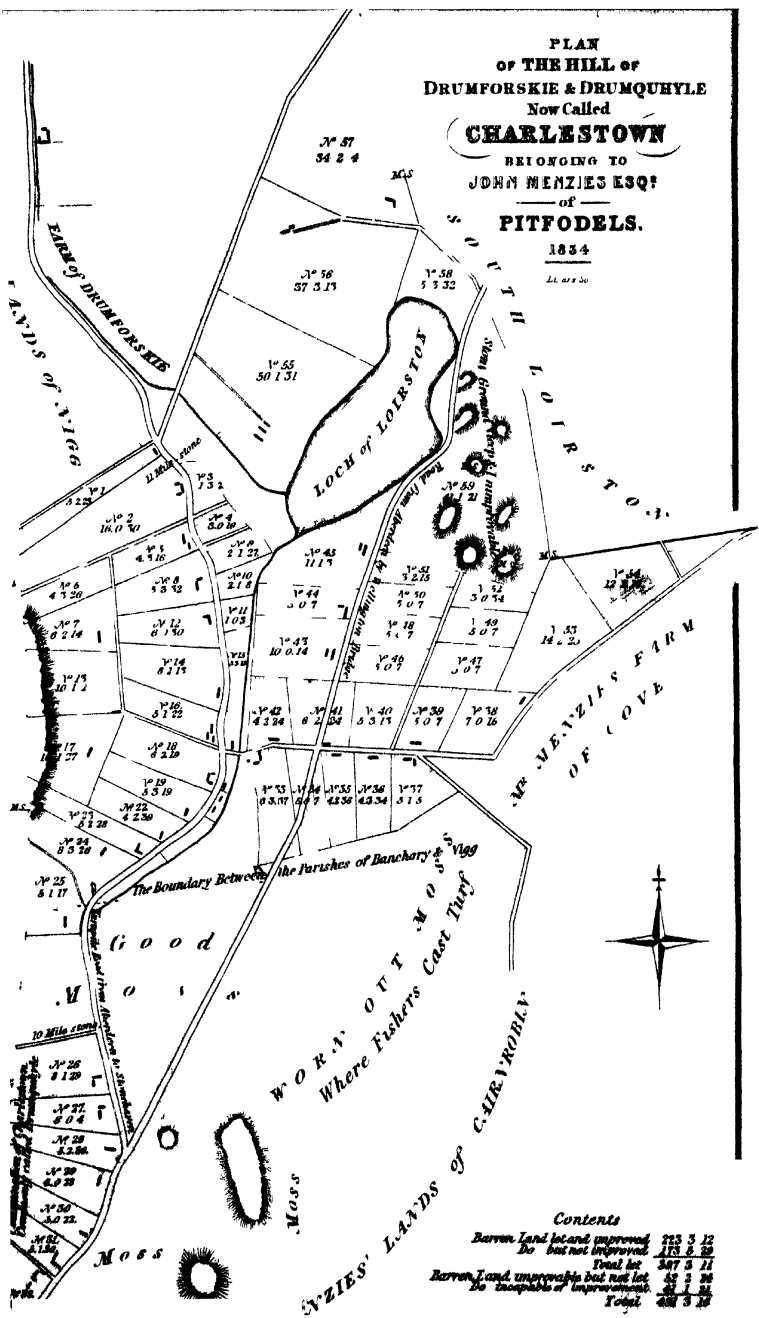
TABLE III.—EARLY VARIETIES GROWN UPON THE 40 DRILLS
OF 120 YARDS.

Nos.	POPULAR NAMES.	Produce on 360 ft., 1834.	Produce per Acre.	
		lb.	lb.	bush.
1	Red Early	267	14,358	208
2	Maysheil Peterson's	527	28,340	410
3	Maysheil Red Roses	310	16,671	241
4	Maysheil Red Early	252	12,664	182
5	Farmer	574	30,868	447
6	Old Rough Black	317	17,047	247
7	Bufis	440	23,662	342
8	Blue Dons	409	21,995	317
9	Black Seedling	306	16,456	288
10	Johnsleugh Peterson's	344	18,499	267
11	Johnsleugh Red Early	345	18,533	268
12	Edinburgh Red Dons	438	23,554	341
13	Irish Apple	574	30,868	447
14	Irish Rough Black	491	26,404	382
15	Irish Seedling	470	25,275	366
16	Biscuit	369	19,844	287
17	Rose Hearty	631	33,933	491
LATE VARIETIES.				
1	Wild	876	47,109	682
2	Peruvian	531	28,556	413
3	Dickson's White Kidney	349	29,524	427
4	Lumpers	713	38,333	555
5	Red and White	802	43,129	625
6	Barbadoes Kidney	488	26,243	380
7	London White Breadfruit	681	36,622	530
8	London Red Breadfruit	916	49,260	713
9	Johnsleugh Red Roses	456	24,522	307
10	Johnsleugh Black Seedling	956	51,411	745
11	Wellington, or Provost	1076	57,864	838
12	Red Potato	616	33,127	480
13	Maysheil John Auchie	548	29,470	427
14	Cups	836	44,958	651
15	Red Roses	500	26,888	389
16	Sanderson's Dunbar	663	35,654	516
17	Late Jersey	622	33,448	484
18	Lawyer's Red	681	36,622	530
19	Breadfruit	528	28,394	411
20	Wellington	641	34,471	499
21	Large Castle	543	29,201	423
22	Lark	666	35,816	519
23	Wales	769	41,355	599

[At p. 47. line 11, of the present volume, for Mr Anderson, read Mr William G. Andrews.]

PLAN
OF THE HILL OF
DRUMFORSKIE & DRUMQUHYLE
Now Called
CHARLESTOWN
BEHONGING TO
JOHN MENZIES ESQ:
— of —
PITFODELS.
1834

Ed. 22. 20



Contents

Barren Land let and improved	223 3 12
Do but not improved	175 8 20
Total let	398 5 11
Barren Land unimproved but not let	42 2 28
Do incapable of improvement	21 1 28
Total	461 3 10

REPORT OF THE SYSTEM OF IMPROVEMENT FOLLOWED ON THE MUIRS OF DRUMFORSKIE AND DRUMQUHYLE, NOW CALLED CHARLESTOWN, IN THE COUNTY OF KINCARDINE, BELONGING TO JOHN MENZIES, ESQ. OF PITFODELS, BY THE SETTLEMENT OF CROFTERS ON IMPROVING LEASES, WITH ALLOTMENTS OF A FEW ACRES OF WASTE LAND TO EACH. Communicated by Provost BLAIKIE of Aberdeen.

[In 1833, the Society offered its Gold Medal to the Proprietor who should transmit the most satisfactory Report of a system of improvement carried on upon his estate, by settling crofters on Waste Land, and allotting to each a few acres of ground for improvement. The premium was adjudged to Mr Thomson of Banchory; but an extra Gold Medal was awarded to Provost Blaikie, for his Report of the more extensive improvements on Mr Menzies's estate].

Situation and Soil.—The muirs of Drumforsk and Drumquhyle, which now form the settlement of Charlestown, and contain in all 491 acres 3 roods 16 falls imperial measure, are parts of Mr Menzies's Kincardineshire estate. Drumforsk, the more northerly, lies in the parish of Nigg; and Drumquhyle, which is separated from it only by a piece of mossy ground, called the Groundless Myres, also belonging to Mr Menzies, is situated in the adjoining parish of Banchory Devenich. The waste land of Drumforsk commences about four miles from Aberdeen, on the turnpike road leading thence to Stonehaven, along which it extends nearly a mile southward, on the west side, but not quite so far on the east, at an average breadth of fully three quarters of a mile; while the muir of Drumquhyle lies wholly on the west side of this road, by which it is bounded for nearly half a mile, the average breadth, however, not exceeding 300 yards, with the moss of Cairnrobin and Coldsea, forming a square of about a

mile, stretching along the east side, opposite the south end of Drumforskier and the whole of Drumquhyle.

Previous to the formation of this turnpike in 1799, this tract of land was literally inaccessible, indeed almost unknown, and a more comfortless and desolate waste could scarcely be fancied. The public road betwixt Aberdeen and Stonehaven passed over the summit of the Tollohill, at the distance of half a mile to the westward, so that there was no communication through the muirs in any direction. They were exposed to the cold blast of the German Ocean, and to the pestilential influence of the adjoining mosses. Under such circumstances, it is almost needless to remark that no part of them exhibited the slightest vestige of cultivation. Short stunted heath, rushes and bent, were the only vegetable substances they produced; large masses of granite, whinstone, and innumerable smaller stones, were everywhere visible; and the general appearance justified the etymology, for Drumforskier is said to be composed of the three Celtic words “drum,” “fuar,” and “skie;” the first signifying “ridge,” the second “cold,” and the last “dreary,” so that the “cold dreary ridge” was, at that time, particularly appropriate and descriptive.

Drumquhyle was rather less forbidding; it lay lower, and was, consequently, not so much exposed to the sea blast; and its etymology, from “Drum,” ridge, and “quhyle,” or, as it is pronounced in the Gaelic, “choille,” or wood, the woody ridge, or “ridge of the wood,” may have been equally applicable; because the adjoining moss was very probably covered at some remote period with wood, an inference which the remains of trees of small dimensions occasionally found in it seems sufficiently to justify.

The execution of the turnpike road above mentioned having, however, been resolved on, and Mr Abercrombie, the engineer employed to survey the line, having recommended that it should pass in its present direction through Drumforskier and Drumquhyle, these muirs were, on its being finished, completely opened up, and much travelling and traffic,

both south and north, very soon took place amongst it ; but the conveniency and accommodation which the road afforded, were generally forgotten in the anxiety of the passing traveller to indulge in satirical remarks on the miserable *terra incognita* which it had exposed. That this is no exaggerated picture, will be apparent from the fact, that Mr Menzies himself was so struck with the wild and lonely appearance of this part of his property, that he had in view to build a couple of cottages by the road side, and establish occupants in them, that, in case of accident, both assistance and shelter might be at hand.

The soil, however, was not so inferior as might have been expected ; it was of a light, muirish nature, varying from black to yellow, in some places sharp and grateful, incumbent, in general, on hard till, or pan, as it is provincially called, from two to four inches in thickness, which the plough could not penetrate ; and the subsoil likewise varied from gravel to a blue sandy clay. The want of access had fortunately prevented the surface from being pared and carried off, and it was likely that, if the water was permitted to escape by sufficient drains, the pan broken and mixed with the rest of the mould, and the whole well limed and dunged, which such ground required to be almost to saturation at first, it would form a fruitful and productive mass, of which the fertility could afterwards be kept up by a moderate allowance of manure. The neighbourhood of, and good access to, Aberdeen, where agricultural produce of every description readily sold at high prices, and where manure of all kinds could always be purchased, formed strong inducements for attempting to reclaim this tract ; but, on the other hand, the difficulty of the undertaking, and the consequent expense of improving, where the plough, in the first instance, was of no use, on account of the quantity of stone, and where the whole required to be dug by the spade and mattock, was such as precluded the idea of effecting the improvement to advantage in any of

the ordinary modes, because no tenant could undertake it, and, if attempted by the proprietor, the expense would have much exceeded the value of the land when improved.

Under these circumstances, the only feasible plan seemed to be to let it off, on improving leases, in small portions, and to encourage settlers by long leases, by aid in money, to erect houses, and by an allowance in lime to such ground as they improved, as soon as it was ready to receive that manure, and so gradually to bring the whole into cultivation by crofting.

The Transactions of the Highland Society shew the improvement of much more extensive tracts of muir ground than Charlestown contains, but these have generally, or at least in many instances, been conducted by proprietors at a very heavy, often at a ruinous, expense, or by tenants having arable land adjacent ; while the reclaiming of so large an extent of muirland, of a nature so untractable and difficult to overcome, disconnected from all cultivated ground, and at so small an expense to the proprietor, has, as far as is known, not been hitherto accomplished in any other case.

The idea of improving Charlestown by settlers first suggested itself to the late Mr Charles Bannerman, advocate in Aberdeen (and from whom the settlement takes its name), who had then the management of Mr Menzies's estates, and indeed the situation was excellently adapted for the system of crofting.

On the border of a large and inexhaustible moss, and in the neighbourhood of stone quarries, the settler had the benefit not only of a full allowance of firing for his own accommodation at his very door, but he had also the prospect, indeed the certainty, of employment, for a considerable part of the year in the quarries, and also in the neighbouring mosses, in which allotments were annually let to be manufactured into peat for the supply of the inhabitants of the town of Aberdeen, and of the tenants of such estates as had not mosses attached to their own possessions ; and, when not so employed,

the trenching of his little croft afforded him occupation at every vacant hour, while the profusion of stones supplied abundant materials on the spot for the rough sort of building and enclosing which were wanted; and poultry and eggs at first, and dairy produce afterwards, when industry had provided keep for a cow, found ready sale, and brought fair prices at all times on being conveyed to Aberdeen.

These circumstances did not escape the penetrating eye of Mr Bannerman; he entered into the execution of the plan he had conceived with heart and hand, and with such alacrity, that Mr Menzies, having had occasion to be from home for some months, was agreeably surprised, as he was returning, to find a cottage erected nearly at one of the places which he would have fixed for a house of refuge, and marks of cultivation appearing around it and another which had been built near the northern extremity.

Roads.—It will now be readily allowed on all hands, that the real and substantial improvement of the soil may be dated from the period of improvement of the great roads of communication; for until as easy an access as possible be obtained to those points where manure and other materials for improvement can be procured, and where produce can be disposed of to the best account, no district can be improved either to advantage or to any considerable extent.

Of this fact the settlement at Charlestown furnishes abundant proof. As soon as the muirs, on which it stands, were laid open by the formation of the turnpike-road already alluded to, cultivation rapidly followed. From the turnpike Mr Menzies some years afterwards made a good road to the eastward, to give access to his property along the coast, when the allotments Nos. 33, 34, 35, 36, 37, 41, and 42, Plate I, being the whole which he was then inclined to give off to settlers in that quarter, were speedily occupied. Again, in the year 1829, he and some other proprietors of the parish of Nigg having resolved to construct a suspension-bridge, now called Wel-

lington Bridge, across the Dee, a little to the westward of Aberdeen, for the purpose of forming a communication with the town, and improving their properties in that parish; and being satisfied that this last object would be materially forwarded by conducting a new road through their estates to communicate with the above-mentioned turnpike, a new line of turnpike-road was accordingly made out nearer the sea, the south end of which passed through another tract of muir-ground belonging to Mr Menzies adjacent to Charlestown, and joined the Stonehaven road near the north end of Drumquhyle. Along this road also Mr Menzies resolved on putting down crofters, and connecting the whole into one settlement; but a very considerable part of the ground thus opened up was not nearly so much obstructed with stones as Drumforsk and Drumquhyle; it was in general so comparatively free from them, that great part could be ploughed, though other parts could hardly be taken in even by trenching.

But the greater facility of improving, from the more tractable nature of the ground, as well as the reduced rate of wages, and the proof given by the crofters of the quality of the land when reclaimed, induced several people in the neighbourhood possessed of a little capital to attempt much larger lots; and accordingly, three quantities of 40, 30, and 25 Scotch acres, to be afterwards noticed, were given off on leases of thirty-eight years, the same duration as on Charlestown. These turnpikes, with two pieces of roads of communication from the Stonehaven turnpike to the high ground on the west, where they communicate by a cross road, and other two pieces leading from the Stonehaven and Wellington Bridge turnpikes, to the large lots immediately above mentioned, all as shewn on the plan, Plate I, have given complete access to every part of the settlement.

Terms and Encouragement.—The terms which Mr Menzies proposed to those who were inclined to settle in Charlestown were, that each crofter should take at least four Scotch,

equal fully to five imperial acres, extending to a fixed distance only along the turnpike road, but with liberty to increase that quantity by extending his improvements backwards in a northerly direction, and to pay rent for four acres from the commencement, and for the additional quantity only as he improved it, which, however, it was his interest to do as speedily as possible, because the sooner he brought it into a state of cultivation, the sooner he reaped the benefit of his exertions. In some cases, however, this was found not to be a sufficient stimulus, and the improvement of the whole allotment fixed upon within ten years was subsequently made a condition of the bargain; but even this has not been strictly complied with. The duration of the lease was fixed at thirty-two years, at the rate of 7s. 6d. Sterling per Scotch, or about 6s. per imperial acre, for each of the first nineteen, and 20s. per Scotch, or 16s. per imperial acre, for each of the remaining nineteen years of the lease, together with a proportion corresponding to his rent of the various public and parochial burdens in which Mr Menzies's other tenants were liable. An allotment of moss sufficient for the supply of one fire was allowed, together with the privilege of pasturage for a cow on the side of the moss during the proprietor's pleasure, and to the original settlers, being those along the Stonehaven turnpike and the road leading from it towards the coast, the sum of L. 10 was advanced to assist in erecting a dwelling-house, one half when the mason-work was finished, the other when the house was completed and inhabited, but for this sum the settler paid interest at the rate of 5 per cent.; and the value of the house, after deduction of the advance of L. 10, was agreed to be paid by appraisement at the end of the lease, not exceeding two years' rent in addition, and, in some cases, what came nearly to the same thing, L. 20 in whole. To the three tenants who occupy the large lots already mentioned, Mr Menzies cut all the main drains, and granted an allowance for building to the extent of a year's rent at the expiry of the

lease, over and above the first year and a half's rent to the largest, and one year's rent to the second and third in extent, which they were allowed to retain and expend in building, accounting of course for this advance at their removal; but to the settlers on small crofts along the road from Wellington Bridge, no allowance to enable them to build was made, because it was found that in some cases people, without any capital whatever, had become settlers for the mere purpose of obtaining a home and firing, who had neither the means, nor the inclination, nor intention to improve, and consequently, very little was done on such lots for a long time.

The last tenants are certainly of a better description than the first, and go on more vigorously, and improve more substantially, than the old did. A great many applicants, on hearing there was to be no advance of money, immediately withdrew, so that none who were not able to complete their houses either from their own funds, or on their own credit, were set down. The rates of rent, however, along the Wellington Bridge road were considerably higher than those along the Stonehaven and coast roads, because the soil was better, more free of stones, and more easily reclaimed. The rents for the first period of nineteen years varied from 7s. 6d. to 12s. 6d. the Scotch, or from about 6s. to 10s. the imperial acre; and from 23s. to 40s. per Scotch, or about 19s. 6d. to 32s. the imperial acre for the second period. It was, however, understood, that the first year's rent would not be insisted on.

These may, strictly speaking, be called the terms. The encouragement was of three kinds. First, Indirect, by not insisting for regular payment of rents; for, at first, many were under the necessity of working hard to maintain themselves and their families at such employment as they could procure, principally, as has been mentioned, at the stone quarries and mosses, so that they could only employ themselves on their own ground at extra hours, or when out of em-

ployment. But by this indulgence Mr Menzies was ultimately no great loser, because, when a sale was effected, the purchaser was not received as tenant until the rents due for the allotment disposed of were discharged, which generally secured the whole.

Second, Direct, in granting an allowance of a small quantity of lime for such ground as was substantially improved, and in a fit condition for receiving it. This, on the whole, amounted to a small sum, certainly under 10s. the Scotch, or 8s. the imperial acre, but it had a very beneficial influence ; it encouraged competition, and a settler prided himself on the quantity of lime for which he was considered to have a claim on the landlord.

Third, Direct also : After some of the cottages had been erected, the late Mr Crombie of Phesdo, who frequently travelled through and took great delight in the improvement of Charlestown, remarked to Mr Menzies, that the windows were so small, as not only to impart a mean and dirty appearance to the houses, but also to render them uncomfortable and unhealthy. He therefore suggested that the proprietor should in all cases insist on the houses having windows, at least $3\frac{1}{2}$ feet high, and 2 feet 9 inches to 3 feet broad ; and that there might be no hesitation about the tenants agreeing to this size, he farther suggested, that the proprietor should also afford windows, in addition to the L. 10 in money, the tenant accounting for their value, along with the L. 10, at the end of the lease. It is almost needless to say, that Mr Crombie's recommendation was afterwards acted upon, and it has contributed very considerably to the erection of a better style of houses. Every facility has also been afforded in the transfer of the lots, by memoranda or entries, signed by the purchaser and settler, in a book kept for the purpose, without insisting on assignations or other deeds ; and no dispute has hitherto arisen in consequence.

Expense of Houses.—Before entering on the question of

expense, it may be remarked, that the appearance of the settlement might have been improved, by binding the original settlers to build their houses on a particular plan, of specific dimensions, and in proper situations ; but at first the natural anxiety to effect the improvement of the land occasioned less attention to be paid to these details. In consequence, some of the original houses were very small and mean, with the dunghills in front, and no appearance of neatness and comfort, and as little of cleanliness about them ; and the generality of them were not placed in any regular line ; some were erected by the road-side, others at a distance from it, some with the gables to it, and so on. The style of house, however, was much improved when windows were allowed, as none were granted unless the side-wall was at least 8 feet high above the door-sole, which was likewise to be 6 inches above the level of the surrounding ground ; and by the terms of agreement of the possessions along the Wellington Road, the dwelling-houses must be all placed at uniform distances from the road, with the offices and dungpits behind, and a neat garden in front ; they must be from 30 to 35 feet long, 16 wide over-walls, 8 feet high in the side-wall, and stob thatched, tiled, or slated. As the stones are found on the spot, the mason-work is very moderate.

In a house of the size which has been mentioned, the mason-work will not exceed 3 roods, which would now cost 50s. per rood, and would amount to L. 7 10 0
 Four windows and a door, 2 15 0
 Sixteen couples, including divot lath, 3 4 0
 2½ roods of thatch, at 25s. 2 18 0

L. 16 7 0

Besides the dwelling-house, a barn built with stones and mortar, about 30 feet by 13, is in many cases requisite, and a byre to hold two cows, a young beast, and probably a horse of a small breed, which will cost in whole about 13 13 0

Total expense, L. 30 0 0

Two of the dwelling-houses are now slated, and two covered with tiles. The whole appearance of the houses of the settlement is gradually improving, by the removal of the dunghills, and the erection of a better class of new houses ; and it will be soon further improved by new buildings being required in place of some of the old, which were originally so slightly put up as to have already become insufficient, and require renewal.

Fences.—On all the allotments there are ring-fences, and in many of them subdivision dikes, all of stone, but of very rough workmanship ; indeed, the erection of such fences was the only means of disposing of the immense quantity of stones which were dug up and brought to the surface in the course of the improvement ; and a kind of dike peculiar to this district, called a consumption dike, was at first very much resorted to. The ordinary application of the term consumption will give a very erroneous idea of this sort of fence, for it is so called because it is stout, strong, and of gigantic dimensions, *consumptive only of stones*. Its general dimensions are from 12 to 18 feet in width at bottom, six to eight feet in height, and from 8 to 12 feet in breadth at the top. As demands occurred for stones, either for building in the neighbourhood of Aberdeen, or for the repair of the roads, and occasionally for ballast to vessels going to ports where small stones were wanted for road-making, an actual consumption takes place among these dikes, to such an extent, that a great proportion of them are now reduced to much more ordinary dimensions, and in many cases the enclosures are now nearly built of the usual sizes. No allowance is stipulated by the terms of agreement to be paid for fences, except in the three large lots, where the value of building only, without reckoning on the stones or carriage, is conditioned to be paid at the end of the lease, by valuation of arbiters or tradesmen mutually chosen, provided they are left completely fencible, and form complete enclosures, and have been built in lines, and

of dimensions approved of by the proprietor or his factor, but not above 6d. per ell, however much they may exceed that price. From the reduction in the value of labour, however, the very best stone dikes can be built under that sum.

The dimensions which have been prescribed for dikes are 3 feet at bottom, 4 feet in height, gradually diminishing to 20 inches at top, with a coping of large stones, 6 inches high, having plenty of thorough bands; that is, long stones passing quite from one side to the other, which add much to the strength and durability of the dike.

Mode of Improvement.—As already mentioned in general terms, the plough could be very little used in the improvement of Charlestown, and even had it been adapted to the purpose, the small settlers could neither afford to hire men and horses, nor to furnish manure for the extent of ground which the plough would in a very few yokings have turned over; but besides, horses of sufficient strength to break in ordinary muir land, could not be obtained on hire in the neighbourhood, neither was there food for oxen, had they been considered more economical, and on that account resorted to. The improvement of every man's allotment, therefore, depended on his own energy, activity, and industry, and the difference in these respects among individuals, was peculiarly striking, and exhibited the literal truth of the old saying, that "one man will live, where another man would starve." Digging by the hand, or trenching, was therefore the mode of improvement almost universally adopted; and in no part of Great Britain, perhaps, is this operation better understood, or carried to a greater extent, than in the neighbourhood of the city of Aberdeen, where a very considerable quantity of land has, from the most barren and unproductive state, been thoroughly improved by this operation, of which a short account is given in the Appendix. But it must not be imagined that in Charlestown the business of trenching was carried on in the complete manner in which that work ought to be, and generally is per-

formed, when the proprietor or occupant is possessed of abundance of capital. The completion of the operation was spread over several years, for as soon as the settler had rendered his house barely habitable, he commenced trenching in his own way a small plot for a yard (garden), in which potatoes, coleworts, cabbages, and other vegetables were planted in the proper seasons, and then he continued his labours on such part of his muir as appeared least difficult in the execution. In most cases all the large stones, which three or four men could by crowbars and levers remove from the soil and lay on the surface, were taken up, the different settlers assisting each other in this operation; but in many instances the larger stones, which required to be blasted or split with gunpowder, were allowed to remain in the first instance, and were afterwards removed as the circumstances of the crofter improved, or after he had in a rough way gone over the whole; or on the accession of a purchaser, the stones were taken to a very short distance from the trenched ground, which was then manured and generally sown with oats the succeeding spring, and another spot selected for acting on in the same manner. In this way the different allotments exhibited a collection of irregular half improved arable patches among hillocks of stones and shreds of heath and bent; but by-and-by there was no vacant space to treat in this fashion, and then the next step was to unite two or more of these arable patches, by removing the stones into the line of the ring-fence, or of a subdivision dike, and improving the barren ground between, and so in process of time the whole became close ground, enclosed in the manner which has already been explained, thoroughly cleared of stones, and capable of producing abundant crops of turnip, potatoes, grass, and the different varieties of grain usually raised in the district.

The manure applied was of various kinds:—Lime imported from Sunderland at Aberdeen, and carried from thence to Charlestown; night soil also brought from Aberdeen; the re-

fuse of fish purchased at the fishing-village of Cove, and of whale-blubber both mixed with moss and the ashes of burned peat, were all made use of, liming being generally to the extent of eight to ten bolls of forty-three imperial gallons per boll for the Scotch, and proportionally for the imperial acre, and the other manure at the rate of about fifty tons to the Scotch, or forty to the imperial acre.

Expense of Improvement.—But to apply this quantity of manure, and bestow the manual labour required for the improvement of so rough a subject, was attended with very considerable expense, and had an account of that expense been correctly kept, it would have shewn that, under any ordinary mode of improvement, the cultivation of Charlestown could not have been attempted ; but it has been long observed that country people put little value on time, and indeed a considerable part of the time spent in the earlier stages of the improvement of that settlement, was so much recovered from listless inactivity and idleness ; for had the original settlers not been provided with the means of employment after their regular hours of work in reclaiming their ground, they would have been lolling by the road-side, or gossiping in the smithy, or probably spending their time and their money, and ruining their health and their morals, in drinking spirits in the nearest alehouse, of which there are too many in the neighbourhood.

By a fair calculation, the expense of the first crop could not be taken at less than L.40 the Scotch, or L.32 the imperial acre, made up of the following items :—

Trenching an acre Scotch measure,	L. 10	0	0
Blasting the stones,	3	10	0
Clearing the ground of large stones, and gathering the small,	5	0	0
Allowance for drainage,	0	10	0
Enclosing by regular dikes,	2	0	0
Carry forward,	L. 21	0	0

Brought forward,	L. 21	0	0
Levelling holes from which large stones have been taken,	1	0	0
Dragharrowing to level the whole,	0	5	0
Ploughing to lay off in ridges,	0	10	0
Harrowing,	0	5	0
Dung 50 tons, and driving at 6s.,	15	0	0
Putting out dung and spreading,	0	10	0
Ploughing in dung,	0	10	0
Lime and putting out,	2	7	6
Seed oats and grass seeds,	1	5	0
Harrowing in and rolling,	0	7	6
	<hr/>		
	L. 43	0	0

So that, if the first crop should be worth L. 8 per acre, there will be L. 35 actually laid out on the improvement of the land. Of this sum, however, not above two-fifths are expended in money, the rest is made up of the crofter's personal labour, which, although he places little account upon it, is in truth precisely as valuable, and is to be equally calculated on as if he had paid the amount to an ordinary contractor.

The foregoing calculation may, no doubt, appear high, particularly the charge for trenching, clearing of stones, and inclosing; but when the quantity of stones on the ground is kept in view, it is really moderate in these respects. Of this some estimate may be found from the fact that on two and a half acres Scotch, or three acres imperial measure, where the stones accidentally happened to be of rather superior quality, and were required for a public building about two miles distant, payment was actually drawn for 880 loads at 1s. 3d. per load, exclusive of carriage, which amounts to L. 55 0 0

And for 72 loads of carriage-way stones

at 12s. L. 43 4 0

Deduct workmanship at 6s. 6d. 23 8 0

19 16 0

Together, L. 74 16 0

Now, although no sum bearing any proportion to this was drawn from the sales of stone, on any of the other lots, yet it

arose not so much from any deficiency in the quantity, as from inferiority in the quality of the material.

Rotation and Management.—The rotation stipulated for by Mr Bannerman was the seven course shift: First, green crop; second, bear; third, grass cut either green or for hay; fourth or fifth, pasture; sixth and seventh, grain; but from the great command of manure, it has now been generally converted into the five shift, with two years grass, and a single grain crop, which is probably the most productive rotation, near a large town, which can be followed.

Returns.—The returns from the improved ground of Charlestown are much the same as those produced on the farms in the neighbourhood; about 5 quarters of bear, of which very little is raised, and the same quantity of oats per Scotch acre, may be taken as the average quantities of grain; 235 stones of hay, and 30 bolls of potatoes, equal to 21,600 lb. avoirdupois, may be reckoned the medium produce on the same quantity of ground, when well treated and in good order, and consequently fully a fifth less per imperial acre. On some lots, where the tenant is slovenly and indolent, there will not be half these quantities; but then the fault lies with the occupant, and must not be laid to the charge of the land. Some patches of wheat have occasionally been tried, but that grain has not been found so profitable as oats and bear, and was very severe on the land. The population is rather dense for attempting beans and pease; but these are not raised in any part of the neighbourhood, although it is likely enough they would answer, could they be preserved.

Progress.—The first allotment was given off in 1806 to Alexander Milne, and up to the time of Mr Bannerman's death in 1813, twenty-two settlers, occupying 96 Scotch, or 121 imperial acres, had been located. The same system of crofting was followed by Mr Bannerman's successors in the management of Mr Menzies's estate, the writer of this report and Mr Patrick Bannerman, who from that period up to the

year 1822 had let off to sixteen settlers the remainder of the original muir of Drumforskie, as well as the allotments on the road leading to the coast, which have been already alluded to, and two or three small lots along the east side of the Stonehaven Turnpike, which were not originally intended to be let, containing in all about 78 Scotch, or nearly 100 imperial acres.

In 1831, the muir opened up by the Wellington Bridge road was laid off, and since that time 140 Scotch, or 176 imperial acres, have been disposed of to ten new settlers; 42 Scotch, or 52 imperial acres, at present divided into nine lots, still remain unlet; and 33 Scotch, or 42 imperial, are not considered susceptible of cultivation by any mode, in consequence of their consisting of small, steep, gravelly hillocks, some of them nearly perpendicular, having in the hollows great masses of stone, which it would be impossible to cultivate, and are therefore intended to be planted.

All these measurements are given in round numbers; as stated in the commencement of this paper, the quantity of muirland comprehended in the settlement of Charlestown was,

	Imperial acres, 491 3 16
Of this there have been let and improved,	Acres, 223 3 12
Let, but not yet improved,	173 3 39
Improvable, but not yet let,	52 2 24
Incapable of improvement,	41 1 21
	————— 491 3 16

Those parts which have been disposed of, and are not yet improved, lie principally on the north or back part of Drumforskie, and along the Wellington Bridge road, where the crofting began on'y in 1831 and 1832, but in a very short time the whole will be rendered arable. Already the face of the country in that direction is greatly improved, and if the attempt to raise some wood around the piece of water marked on the plan the Loch of Loirston, should prove successful (although, from its exposed situation to the sea blast, this is rather problematical), the effect will be excellent, and the

settlement will be as much noted for its cheerful and comfortable appearance, as it was at first remarkable for its dreariness and gloom.

Stocking.—Along with the improvement of the land the quantity of the farm-stocking on Charlestown has not only increased proportionally, but the quality also. Within a year or two after operations were commenced, two or three cows of the most diminutive kind made their appearance, and by great industry picked up a scanty subsistence during the summer along the road-side and in the moss; by-and-by an equally dwarfish calf was seen accompanying the mother, next year a larger cow and better calf, and so progressively, until the number of black cattle on the settlement amounted at Whitsunday last to sixty cows and twenty calves and queys, all of a size well calculated for the situation and the provender raised upon it. In like manner the first horses introduced into the settlement were of the poorest description, and some of them are so still; but the number now amounts to twenty-two, among which are several handy active Garrons, fit for cart and plough, and possessed of sufficient strength for any ordinary work that can be required of them. The carts are fair and the tackling good, such as is to be seen among the small farmers in the vicinity of Aberdeen, and in these articles a marked improvement has been observed of late years.

Inhabitants.—The total number of houses on Charlestown, at Whitsunday last, was 46, inhabited by 63 men, 63 women, and 105 children, in all 231 souls. The men are principally employed in working in the granite quarries, and in the neighbouring mosses. Those who have horses carry stones and peats, and occasionally fish, to Aberdeen. There are also a blacksmith, a shoemaker, and some other tradesmen, and two or three public-houses, all of which last could well be dispensed with. The women and grown up children assist in the management of the ground, by spreading dung,

planting potatoes, hoeing turnip, gathering stones, and other light work of that nature; they likewise cut down the crop, pull the turnips, feed the cows, and dress the grain after it is thrashed, carry and dispose of the poultry and dairy produce in Aberdeen; and they also have good employment in summer in wheeling, spreading, and setting peats, as well those in the neighbouring mosses intended for sale, as those of the farmers in the vicinity, who find this the most economical method of procuring their peats, and cheaper than if they were to attend to and conduct the whole operations themselves. With such assistance the tenant himself is enabled to earn his daily wages without much interruption; and being provided with a house and fuel, besides meal and vegetables, an industrious man finds himself in a very comfortable situation.

About ten years ago a school, with accommodation to a schoolmaster, was erected, and sufficient ground, now improved, set apart for a garden. The school is attended during summer by about thirty boys and girls, and in winter the number generally rises to sixty. The school fees are small, and all the settlers send their children at one time or other to school, but in too many instances for so short a space that they do not profit so much as could be wished.

Increase of Value.—The yearly rents under the improving system during the last nineteen years of the respective leases, amount to, L. 358 4 6

And, if to this be added the value of 41 acres

3 roods 39 falls, Scotch measure, not yet

disposed of, at 20s. 41 15 6*

L. 400 0 0

even during the period of improving; but at the expiry of

* Since Whitsunday last No. 53, containing 11. 2. 20 Scotch measure, has been let off for L. 5, 10s. the first nineteen years, and L. 18 for the remainder of the thirty-eight years' lease.

these leases the whole will average at least 40s. per Scotch acre, and will, with the accommodation of houses, produce on 357 acres an actual permanent and sure revenue of L. 750 per annum.

In this statement there is no deception. The demand for a house and small lot is great and constant, and in many parts of the neighbourhood, still farther from Aberdeen, land of equal quality is let considerably higher. Here the low price of grain does not affect the tenant, because his family requires all that he can raise. His rent is paid from the produce of the poultry-yard and dairy, and work of his family in the moss, and a year old stirk makes up the balance, should these not be sufficient; and his own earnings go to provide clothing and such necessities or luxuries as he finds it requisite to purchase, or prudent to indulge in.

General Observations.—In the formation of such a settlement as Charlestown, a general plan and allotment of the ground, as well as a plan and specification of the style of building, ought to be adopted and strictly adhered to, and the situation of the cottages ought also to be fixed, otherwise great irregularity and unsightliness will ensue. Great care ought also to be taken to regulate the wells and watering-places, in such a manner that the rights of the various settlers may be perfectly distinct and well understood, otherwise continual jarrings and disputes will be the inevitable consequence.

Among this description of people there is a strong desire for litigation; and although the writer of this paper, by his personal influence among the inhabitants of Charlestown, has been able to keep many petty differences out of court, he has not always been successful, and he has often regretted, that in the original bargains the crofters were not taken bound to submit to the decisions of a baron court in all disputes among themselves, under the penalty of forfeiting the lease, and all benefits arising from it. He would strongly recommend a

condition of this sort in any new settlements that may hereafter be attempted.

It is not to be supposed that all the settlers on Charlestown have been well-doing and industrious; quite the reverse. Many came there, tempted by the mere accommodation of the house, who had neither the means to improve, nor the requisite habits of industry. Of these the greater proportion, in consideration of some small premium, speedily disposed of their lots, and made way for others who were possessed of a little capital, which not unfrequently enabled them to overtake their neighbouring improvers. Sales have been encouraged, because they were always attended with advantage to the settlement, as the new comers had almost universally something more than what was barely sufficient for the purchase, and the surplus was as regularly laid out in improving the buildings and the ground. It ought, however, to be particularly attended to, that no settler should be permitted, either originally, or by purchase or succession, or in any other way, to hold more than one lot, unless he personally occupies the whole himself, at all events till the whole is completely improved, or to divide his lot, and dispose of part. Every man ought to reside with his family on his allotment, and not hold part as a tenant and part as a middleman.

It has uniformly been observed by those conversant in the management of estates, that there are, generally speaking, no harder masters than tenants themselves, when they have it in their power to subset parts of their grounds, and no class of men more oppressed than their unfortunate undertenants. If, therefore, one settler is allowed to hold two or more lots, the chance is, that the improvement of every one of them will be checked. He lets what he does not occupy himself at such an exorbitant rate, that the possessors can scarcely pay the rent by the hardest labour, so that they have neither means nor time to bestow upon their land; and the middleman, if he condescends to reside, relies on the rent he exacts from his

dependents, and neglects the improvement of his property. If, however, only as much as he can himself manage is allowed to each settler, who must reside, his attention cannot fail to be directed to the improvement of his allotment; he holds it at such a moderate rate, that he can afford to spend a little upon it; and he finds the many advantages it gives him too sensibly to hesitate in putting it, and keeping it, in the best order that he can afford. By stimulating such men to perseverance in the improvement of their crofts, by trifling presents of lime for part of their newly improved ground, by cutting a drain occasionally when wanted, and similar marks of approbation, and so saving them the actual advance of money, a large extent of barren ground may be very speedily brought into a state of improvement, and that improvement be completed at the least possible expense.

· APPENDIX.

Trenching.—The mode in which trenching ought to be performed, is for the labourer to line off a part of the barren ground, not under 6 nor above 8 yards for each man, and not more than 1 yard in breadth; he throws out both soil and subsoil to the depth of full 16 inches from this space, and so forms the first trench. After completely levelling the bottom of this trench, he lines out another, and commences filling up the first, by cutting off a stamp of not more than 6 inches in thickness from the surface of the second, which stamp he lays inverted into the bottom of the first or open trench; and he continues digging and laying the loose earth upon the first stamp, until he has dug the second trench to the requisite depth, carefully removing every fast stone which he can discover, and putting them, as well as all smaller ones he meets with, upon the trenched surface, so that they may not be buried in the mould. But it frequently happens that the spade is not sufficient to

pierce through the stony ground, in which case a kind of mattock, provincially termed a pick, must be applied. With this instrument the stones and earth are loosened to the depth of several inches, and the earth then thrown into the adjoining trench with the spade. The picking is again proceeded with, and the stones and earth again thrown out, until the requisite depth be obtained.

It ought to be particularly attended to, that no ridges or fast spaces, generallly called grips, are left between the trenches, as dishonest labourers are apt to do, and that the trench is cut perpendicularly, and not in a sloping direction ; because, in the latter way, the employer has only the appearance of the full depth, without the reality. When there happen to be large stones which the pick is not sufficient to raise, iron crowbars, from 3 to 5 feet in length, are applied, and not unfrequently wooden levers, shod with iron, of several yards in length, are resorted to. But even these are often of no avail, and then gunpowder must be used, and the stone blown in pieces, and broken into such fragments as can be easily laid on the surface and removed from the ground. Small farmers and others, who are unable to be at the expense of blasting with gunpowder, build the stone round with turf and other fuel, which they set on fire, and the great heat splits the stone frequently as effectually as gunpowder.

It is of vital importance that every stone, both great and small, that appears in the trenching, as well as every one that may be observed at the bottom of the trench when dug to the proper depth, should be taken out, and that the holes from which they are removed should be filled up and levelled.

Should it happen that 16 inches of the solid ground, owing to a number of stones or other causes, do not yield at least 18 inches of mould, the labourer ought to go to such additional depth as will give full 18 inches, for a less quantity will not be found sufficient for the purposes of agriculture.

MEASUREMENT AND RENT OF CHARLESTOWN ALLOTMENTS.

No.	Tenants.	Measurement.			Rent per acre 1st 19 years.	Rent 1st 19 years.			Rent per acre 2d 19 years.	Rent 2d 19 years.		
		A.	R.	F.		L.	s.	d.		L.	s.	d.
1	George Gibson, . . .	4	1	36	7 6	1	13	6	20	4	9	6
2	Alex. Milne, . . .	12	3	20	do.	4	16	0	do.	12	17	6
3	Harry Ronald, . . .	1	1	24	do.	0	10	6	do.	1	8	0
4	John Gibson, . . .	2	1	36	do.	0	18	0	do.	2	9	6
5	John Collic, . . .	3	3	16	do.	1	8	6	do.	3	17	0
6	Do.	3	3	24	do.	1	9	0	do.	3	18	0
7	Harry Ronald, . . .	5	0	36	do.	1	19	0	do.	5	4	6
8	Widow Troup, . . .	4	2	35	do.	1	15	0	do.	4	14	0
9	Andw. Donald, . . .	1	3	27	do.	0	14	0	do.	1	18	0
10	James Mutch, . . .	1	3	12	do.	0	13	6	do.	1	17	6
11	Do.	0	3	10	do.	0	6	0	do.	0	16	0
12	Widow Coutts, . . .	4	3	25	do.	1	16	6	do.	4	18	0
13	Mrs Laing, . . .	8	0	22	do.	3	1	0	do.	8	2	6
14	Al. Coutts, . . .	6	3	9	do.	2	11	0	do.	6	16	0
15	Thos. Nicoll, . . .	4	2	20	do.	1	14	6	do.	4	12	6
16	Wm. Coutts, . . .	4	1	4	do.	1	12	0	do.	4	5	6
17	Peter Coutts, . . .	8	1	2	do.	3	2	0	do.	8	5	0
18	Mrs Laing, . . .	5	1	0	do.	1	19	0	do.	5	5	0
19	Peter Gray, . . .	4	2	25	do.	1	14	6	do.	4	13	0
20	John Symon, . . .	0	1	14	do.	0	2	6	do.	0	6	6
21	James Duff, . . .	1	0	9	do.	0	7	6	do.	1	1	0
22	John Joss, . . .	3	3	2	do.	1	8	0	do.	3	15	0
23	James Coutts, . . .	4	2	0	do.	1	13	6	do.	4	10	0
24	Alex. Duncan, . . .	7	0	11	do.	2	13	0	do.	7	1	0
25	James Donald, . . .	4	1	0	do.	1	11	6	do.	4	5	0
26	Peter Ewen, . . .	6	2	30	do.	2	10	0	do.	6	13	6
27	Widow Stewart, . . .	4	3	5	do.	1	15	6	do.	4	15	6
28	Widow Anderson, . . .	4	2	7	do.	1	14	0	do.	4	10	6
29	John Howie, . . .	4	3	24	do.	1	16	6	do.	4	18	0
30	Andw. Anderson, . . .	4	0	12	do.	1	10	6	do.	4	1	6
31	James Lyon, . . .	4	1	10	do.	1	12	0	do.	4	6	0
32	John Gordon, . . .	4	1	0	do.	1	11	6	do.	4	5	0
33	Mrs Laing, . . .	5	2	6	do.	2	1	6	do.	5	10	6
34	Peter Cameron, . . .	4	0	0	do.	1	10	0	do.	4	0	0
35	Jean Mathieson, . . .	3	3	0	do.	1	8	0	do.	3	15	0
36	George Milne, . . .	3	3	30	do.	1	9	6	do.	3	18	6
37	John Shepherd, . . .	4	0	30	do.	1	11	0	do.	4	3	6
38	David Allan, . . .	5	2	21	10 0	2	16	0	30	8	8	0
39	George Rust, . . .	4	0	0	do.	2	0	0	do.	6	0	0
40	James Cowie, . . .	4	2	20	do.	2	0	0	do.	6	0	0
41	John Miller, . . .	5	0	36	7 6	1	19	0	20	5	4	6
42	Andw. Anderson, . . .	3	2	30	do.	1	7	6	do.	3	13	6
43	Widow Hunter, . . .	8	0	0	10 0	4	0	0	30	12	0	0
44	James Cowie, . . .	4	0	0	do.	2	0	0	do.	6	0	0
45	George Duncan, . . .	8	3	30		3	17	0		12	3	0
46	Unlet 1st July 1834, . . .	4	0	0								
47	Do.	4	0	0								
48	Do.	4	0	0								
49	Do.	4	0	0								
50	Do.	4	0	0								
51	Do.	2	3	16								
52	Do.	2	2	8								
53	Let since 1st July 1834, . . .	11	2	20								
54	Donald Sinclair, . . .	10	0	0	12 6	6	5	0	40	20	0	0
55	Alex. Milne, . . .	40	0	0	10 0	20	0	0	25	50	0	0
56	Charles Kennedy, . . .	30	0	0	8 0	12	0	0	23	34	10	0
57	Al. Bain, . . .	25	0	0	7 6	9	7	6		28	2	6
58		4	2	35								
59		32	3	10								
		A. 389 3 39				L. 129 11 6				L. 358 4 6		

[In inserting this report in their Transactions, it is not proposed to give the sanction of the Society to the principle of the method of improvement there described. The Society has hitherto laboured to elevate the condition and character of the Tenantry of the country, as the surest means of introducing beneficial improvements; and it may admit of grave question how far any considerable improvement of the surface of this country should be attempted by means of the class of tenants now described. Circumstances, indeed, may render it practicable to raise the value of landed property by the introduction of such tenants; and the case of the estate of Mr Menzies, so well described in the preceding report, appears to be one in which the means employed have been prudent, and in which the result has been favourable.]

REPORT ON THE INTRODUCTION OF CERTAIN NEW FOREST TREES INTO THE CULTIVATION OF SCOTLAND. *By Mr THOMAS BISHOP, Land-Steward, Methven Castle.*

[The following report on the cultivation of certain species of pine, was transmitted to the Society in reference to an annual premium offered for the introduction of any new species of tree into forest or ornamental plantations. The premium was adjudged to its author.]

THE following account of new trees, which I have successfully brought under cultivation, on muir lands belonging to Robert Smythe, Esq. of Methven, in the county of Perth, I beg leave to offer to the consideration of the Society. The first that I have to notice is the *Pinus Cembra*, a native of the highest mountains in Switzerland, and said to have been first introduced into Britain about the year 1819. It belongs to that class of pines termed quinate, having five leaves in one sheath, of a faint green colour on the outer side, and glaucous within. Its habit of growth is strictly perpendicular and regular, although not rapid, with a tapering stem or trunk from the bottom to the top, and the timber, as reported by travellers, is of greater durability than that of the larch, amongst which it is occasionally found growing, but more commonly at a higher altitude. The oldest tree of the kind under my charge, was

raised from seed given me by George Smythe, Esq. advocate, about the year 1821 or 1822. One plant was left standing where it was sown within the garden on a border exposed to the north, which has now attained the height of nine feet, and measures twelve inches at bottom in circumference.

But in order to make known the circumstances under which this and the other species hereafter to be noticed have given demonstration that they are suited for a poor soil, and cold climate, it will be necessary for me to state, that, in the spring of the years 1830 and 1831, I was employed in planting a tract of muir ground, upwards of 600 feet above the level of the sea, with larch and Scotch fir; and thinking how very interesting it might hereafter become to botanists, if not advantageous to arboriculturists, if I should collect all the species and varieties of the pine and fir tribe that could be got at a moderate rate, and plant them in parcels contiguous to each other, for the purpose of comparison, either as to variety or adaptation for similar situations as to the production of timber, I for this purpose selected a portion of ground, of irregular surface, varying in degrees of dampness, distinguished from other parts of the muir by the Gaelic name of Glash-bhaad; and here I began to form a pinetum, being encouraged thereto by Messrs Dickson and Turnbull, nurserymen, Perth, and others, who furnished me with species and varieties of the coniferous plants in their possession, at an under rate. Observing the regular growth and apparent hardness of the Cembra pine above alluded to, I was induced to purchase from Mr Lawson, Edinburgh, twelve plants of the same kind in pots, at one shilling each, which I also planted there from ten to twelve feet apart, without any preparation of the ground farther than making pits for the reception of their roots, with a narrow cut on the lower side to draw off the superfluous water that might collect therein. Two years afterwards on finding that these plants were prospering better than many of the other species which I had planted at the same time, I again purchased from the Perth nursery fifty

plants of a less size, which I planted in a *moister place* near to the former, with the view of ascertaining the extent of dampness under which they would thrive ; and these continue to exhibit an equally healthy state with those first planted.

I have only to notice farther on this pine, that last spring I planted out on the same muir one hundred two-year-old seedlings, raised by Mr Sang, nurseryman, Kirkaldy, on the open ground, in the same manner as Scotch fir ; and so satisfactory is their present appearance, that Mr Smythe has given me instructions to continue the cultivation of this species to as great an extent as plants can conveniently be obtained.

The next new species that I wish to bring under the notice of the Society, is the *Pinus Douglasii* or *Californica*, which was introduced to this country from seeds collected by Mr David Douglas on the north-west coast of America in 1827. It belongs to the fir division of the pine tribe styled *Abies*, whose leaves are not in parcels, but solitary, and generally flattened. During the few years that this species has been in the country, it has given great promise of becoming a valuable acquisition to its arboriculture, and in no situation more distinctly than on the muir ground above described,—the leading shoots of this season measuring $16\frac{1}{2}$ inches in length, with a proportional quantity of lateral branches. It is said to attain a great height in its native clime.

The third species that I have to notice, as indicating qualities suited to the soil and climate of Scotland, and which I would presume to style the *Prince of Pines*, if the characteristics of its maturer growth bear any correspondence to those which it has exhibited since its introduction, is known under the name of the *Pinus ponderosa*, and was first raised in this country in 1828 from seeds sent home by Mr D. Douglas from North America. It belongs to that division of pines termed *Ternatæ*, having three leaves or spines in each parcel, their strength and length exceeding those of the pinaster ; and none of all the other species of the fir tribe with which I am acquainted equals it in the grandeur of its ap-

pearance in its youthful state. Hitherto I have had only one plant subjected to the experiment of cultivation on muir land, and it far outstrips all the other specimens planted at the same period, the leading shoot of the present year measuring 16 inches in height, and 2 inches in circumference.

The fourth and last species of recent introduction which I shall particularly notice, and which, from the appearance of plants now under my cultivation, bids fair to become available for the poorer soils of the country, is the *Pinus Carmanica*, which was raised from seeds sent from France to Mr J. C. Loudon, Bayswater, under the name of *Pinus resinosa*. A portion of these he distributed amongst sundry of his correspondents, and from the produce of some seeds sent to my friend Mr Gorrie at Annat Garden, I obtained a few plants, which I kept two years in nursery ground, and thereafter planted them out in the muir in the same manner in which the Scotch fir (*Pinus sylvestris*) is usually treated. They have continued to grow most freely, producing annual shoots surpassing in length those of the common fir near to which they were planted. This species belongs to the same division of pines with the Scotch fir, termed *Geminatæ*, producing leaves in pairs, but the specific difference is particularly obvious, from the former having longer and more slender leaves, the lateral branches more numerous, horizontal, and flexuous, and the bark of a brighter yellow colour.

In addition to the above species, I might enumerate some others of the newly introduced pines that I have subjected to the same experimental test, on purpose to ascertain how far they are suited for the production of timber on the waste or muir lands of Scotland, of which the *Morinda*, *pungens*, *Frazerii*, *nobilis*, *Sabiniana*, and *Laricio* form a part, and of these I may hereafter have it in my power to report; but as sufficient time has not yet elapsed to determine their hardiness and manner of growth, whilst many years must still pass away before the qualities of their timber can be ascertained, I forbear to notice them farther.

[illegible]

British Males

Age Group	Percentage in Labor Force
15-19	~10%
20-24	~25%
25-29	~45%
30-34	~55%
35-39	~65%
40-44	~75%
45-49	~80%
50-54	~85%
55-59	~90%
60-64	~95%
65-69	~98%

1000

ACCOUNT OF THE ISLAND OF ARRAN. *By Mr JOHN PATERSON, Factor to his Grace the Duke of Hamilton and Brandon.*

[The Society's Honorary Silver Medal was adjudged to the author of the following Essay, an annual premium having been offered for Reports descriptive of particular districts in Scotland, and referring more especially to their agricultural condition.]

THE island of Arran is situated in the Frith of Clyde, about thirteen miles distant from the coast of Ayrshire, six from Kintyre in Argyleshire, and nine from Bute. Its length from north to south is about twenty miles, and its breadth is generally about ten miles. In form it is an irregular ellipse, indented by several bays and inlets, none of which are very deep, and of which the larger diameter is nearly north and south.

Including the two small islets of Pladda and Holy Isle, the area of Arran is about 100,000 Scots acres, of which 11,179 are arable, and 613 are planted woods. There is also a very considerable extent of natural wood.

Bute, Arran, the two Cumbrays, Inchmarnock, Pladda, and the Holy or Lamlash Isle, compose the county of Bute. Little is known of the early history of Arran. It was the original patrimonial property of the Crown, and belonged, in 1334, almost entirely, it is believed, to Robert the Second. Donald, Lord of the Isles, ravaged it in 1456. At this period it was possessed by James the Second; but in the next reign, by far the greater part came into the Family of Hamilton, as the portion of the King's sister, who married Lord Hamilton.

Viewed from the sea, at a distance, Arran has a very picturesque appearance. The outline of Goatfell, and the ad-

joining hills, is exceedingly bold and serrated. The lofty rocky summits, often shrouded in clouds, and the dusky heath-clad hills, give to the scene a character of wild and savage grandeur, which strongly impresses the beholder with awe and admiration. On a nearer approach, the deep glens, ravines, and corries, with the towering mountains among which they are inclosed, present many fine subjects for the pencil. The valleys are almost all watered with streams, some of which are of considerable size, and present many beautiful falls, which are often finely ornamented with natural birch, oak, ash, service or rowan, and hazel trees.

A chain of mountains, of which the northern portion is much higher than the southern, traverses the island in its whole length. Goatfell, which may be said to rise immediately from the sea, has an elevation of nearly 3000 feet, and some of the neighbouring mountains are little lower. From the middle ridge, the country falls somewhat rapidly on the eastern, but more gently on the western side. At Shiskine, Lamlash, Brodick, Lochranza, and other places, there are considerable tracts of level arable land in the valleys, backed by rising grounds, steep hills, rocks, and wooded banks.

Arran has from a remote period been divided into five unequal portions, viz. *Brodick, Lamlash, Southend, Shiskine, and Lochranza*. These districts will be seen on the accompanying map, which has been reduced from a large plan laid down from actual measurement, and believed to be very accurate.

1. *Brodick District*, from Clauchlands Point to South Sannox.

The Bay of Brodick is generally considered one of the most beautiful in the Highlands. It is enclosed by high grounds and lofty mountains. The valleys are of considerable extent, very level, little elevated above the sea, and the soil of many of them is composed of the debris of granite brought down by the streams. On the sloping banks and

ridges, rising from the flat part of the valleys, the soil is generally a hazel loam, mixed with gravel; and, beyond this, it is moorish or peaty. The land in the valleys differs greatly in quality, some of it being very gravelly, some sandy, some a fine alluvial loam, but all more or less mixed with moss. In Glenrossie, Glensherrig, and Glencloy, the levels of the valleys run to some distance inland, and are watered by streams of considerable size.

From Brodick to the north-east boundary of this division, there is very little arable land, except at Corrie, where a good deal is under the plough; but it lies in detached portions, separated by rocks, ravines, and brushwood, and is generally very steep. In this part of the district, the hills generally rise very near the sea, there being only a very narrow stripe of arable soil, not more than a hundred yards broad along the coast.

At Corrie there are quarries of fine hard durable sandstone, both red and white, of which a considerable quantity is annually exported to the Clyde, Ireland, and other quarters. Castle Mona, in the Isle of Man, is built of the Corrie white sandstone. Limestone also is exported to the Clyde to a considerable extent. It is of excellent quality, and is taken from the sides of the steep and high banks, by mines driven into them from very near the sea level.

Corrygills and Stra'whellan lie next to the southern boundary of Brodick district. At these farms a narrow band of arable land stretches along the shore, from which rises a rocky bank, and above that is a beautiful sloping and undulated tract of cultivated land of good quality, principally light coloured loam mixed with gravel, with here and there patches of moorish soil.

On Claulchlands Point, at a considerable elevation, is situated one of the ancient forts, often called British, so common in the north and west of Scotland. It appears to have been

surrounded with a mound of earth, except on the side next to the sea, where there is a high and almost perpendicular rock.

On the north side of the Bay of Brodick, about the middle of this district, on a fine wooded bank of considerable height, stands Brodick Castle, one of the mansions of the Duke of Hamilton, surrounded with extensive woods of great beauty, and having Goatfell and Bennish for the back-ground. Glenrossie, well known to the lovers of picturesque and wild scenery, is in the vicinity. The Castle overlooks the Bay, with Ayrshire and the more remote hills of Galloway in the distance. It is an old and irregular building, of considerable extent, and partly habitable. A small angular bastion joined to it, is believed to have been built by Cromwell, who kept a garrison here for some time; but the inhabitants, disliking the soldiers, rose upon them when they were out foraging, and dispatched the whole of them. In the dungeon are still seen the stocks, in which offenders were confined in ancient times.

At Glencloy on this bay, about a mile from the sea, is Kilmichael, a beautiful secluded residence, belonging to John Fullarton, Esq. This, and a farm on the west side of the island, are supposed to have been given to an ancestor of the present proprietor by Robert the Bruce, for services performed to him while in Arran. Near the shore, all round the bay, there are neat villas and cottages, and the place is much frequented in summer by families from Glasgow.

At Mossend, Mayish, and other places in this district, there are large upright rough unpolished stones fixed in the earth, some of them ten or twelve feet high. They were most likely erected for the purpose of marking the graves of chiefs or warriors, the sites of battles, or other remarkable events.

In this division there are 1424 Scots acres of arable land, and 524 acres in wood and plantations. The arable land is generally inclosed and subdivided with stone walls and thorn fences.

2. Lamlash District, from Clauchland's Point to Largybeg Headland.

In this division there are 2074 Scots acres of arable land, and $28\frac{1}{2}$ acres of plantations, besides a considerable space under natural wood. The hills do not rise to a great height, none exceeding 1200 feet. They are less rugged and precipitous than the Goatfell range; some of them are covered with grass to the summits, others with grass on their lower, and heath on their upper parts.

From Clauchlands, the most northern part of the district, to Lamlash village, the country slopes gently to very near the sea, where a low rocky ridge occurs, between which and high-water mark there intervenes a stripe of arable land, having a light sandy soil on a substratum of shell-marl, which is very thin, and mixed with peat and sea sand. Above this ridge the soil is generally a light sandy and gravelly loam, with patches of moss here and there, the subsoil sand or gravel, but in some places clay intermixed with gravel and sand.

Lamlash is a neat little slated village, having the parish church at one end, and built in the form of a crescent facing the sea. Before it there is a deep bay, guarded on the east by the Holy Isle, which stretches across its front, leaving an entrance on the east and another on the south, sufficient for the largest vessels. The roadstead in the Bay is one of the best in the west of Scotland. The bank above the village is beautifully wooded, and the valley behind is well cultivated and inclosed, the soil being alluvial loam, often mixed with gravel and sand on a gravelly subsoil.

Lamlash or Holy Isle, which is rather less than two miles distance from the village, has a very bleak appearance, and contains only about twenty-five acres of arable land. Here there was once a religious house of some note, and a burying ground which was used by the inhabitants of Arran at no remote period. In this island also, St Molios, a disciple of Columba,

is said to have lived in a cave, which, with his bath, is still shewn to strangers.

Kingscross, Auchencairn, and Knockenkelly, to the south of Lamlash, contain a considerable extent of arable land, generally situated at the height of fifty or sixty feet above the sea. It was at Kingscross that Robert the Bruce watched the signal which was to be lighted at Turnberry Point, if it were thought advisable to raise his standard in Carrick ; and there, too, if we may credit the tradition of the country, he took the lesson of perseverance from the spider.

The portion of country from Knockenkelly to the headland of Largybeg is well known by the name of Whiting Bay. Here the land generally declines gently to near the sea, where there is a rocky ridge of no great height, and a narrow band of arable land having a subsoil of marl. The hills are of less height, but more varied in form than at Lamlash. Along the shore a number of neat villas and cottages have been built, and the place is much frequented by sea-bathers from Irvine and its neighbourhood. The arable land is generally light, and with a very irregular surface.

Coffins composed of six unhewn flags are very common in this district, and indeed in many other parts of the island. They are not generally long enough for a grown person, so that the bodies must have been bent. Besides the larger graves are often found smaller ones, in which the people say the dogs were interred.

3. *Southend District*, from Dipping Headland to Corriecravie Point.

This is the most valuable of the five districts, and contains 4056 Scots acres of arable land, which is generally of a stronger and more clayey nature than in any other quarter of the island. A stripe of cultivated ground extends along the shore, as in other parts, but is here of greater breadth and

better quality. The rocky barrier interposed between the arable land and the interior is generally of considerable height ; and it seems probable that at a former period the sea had washed its base. Indeed, tradition states that much land has been gained at Glenrossie, in the Brodick district, as well as in other places ; and at the White House in Lamlash district, when a drain was lately cut for the purpose of drying a marshy piece of ground, the foundation of a castle was discovered some feet lower than high-water level. Except where the streams enter the sea, the greater part of the cultivated land in this district lies at a greater elevation than in the rest. Though the surface is generally undulated and traversed by streams, it is in several parts very level, and in almost all is easily cultivable to an extent of from one to two miles from the coast. In the interior, also, there are several farms containing a considerable portion of arable land situated much higher than that near the sea. The hills in this quarter do not rise to more than 1200 feet above the sea, and are covered to the top with heath and grass. Although the soil in this division is generally of a more clayey and tenacious kind than elsewhere, yet in various parts mossy, moorish, gravelly, and loamy soils are to be found. The subsoil is, for the most part, clay mixed with sand and gravel, and is very hard and retentive of water.

At Dipping, Bennan, and Corriecravie, the rocks rise almost perpendicularly from the sea, and are in many parts highly picturesque. On Pladda, a small rock-bound islet lying within a mile of the south side of Arran, a lighthouse has recently been erected ; and, nearly opposite, on the lands of Kildonan, perched on a precipitous rock, is the ruinous castle of that name. It is one of those square towers so often seen in Scotland, and must, before the use of gunpowder, have been a very secure stronghold. The view from Dipping, above Kildonan, in the direction of Pladda, Bennan-head, and Ailsa Craig, with Carrick on the left, and Ireland at a greater distance, is very fine ; as is that from the same place in the

direction of Kingscross, the Holy Isle, and the counties of Ayr and Argyll. This district, however, is not of so strikingly romantic an appearance as some of the other portions of the country. The want of wood is very much felt, there being merely some alder and brushwood in the glens. At Ben-nan and Corriecravie are the remains of two forts, similar to that already mentioned; but in these instances a fence of stone, built without mortar, appears to have been carried round the tops of the elevations on which they were situated, and no traces of buildings have been observed within these rude dikes.

4. *Shiskine District*—From Corriecravie to Auchagallon.

This division may be described as a level cultivated valley four miles long, very narrow at the upper end, and gradually increasing in breadth to rather more than three miles at the sea. There is a considerable extent of arable land on the sides of the valley, and a river flows through the flat, joined by rivulets from the adjoining hills, which on the north side are of great height, being part of the Goatfell range. The valley is generally composed of excellent alluvial soil, with a gravelly substratum; and there is also a considerable breadth of moss, especially at its upper end. At Kilpatrick, Drimadown, and Machrie, on the shore, the soil is light, sandy, and gravelly; and on the slopes of the hills which bound the valley, gravelly loam and moorish soil predominate.

At Drimadown there is a fort of the kind already described, which seems to have been of greater extent than any other in the island; and in the middle of the muir of Tormore, not far above the level of the sea, are still to be seen the remains of what have been called Druidical Circles, consisting of tall unhewn stones placed upright. No entire circles, however, remain, although it is easy to trace where they have been.

Along the shores at Kilpatrick and Drimadown, are several magnificent natural caves in the red sandstone. One of these, called the King's Cave or Cove, is supposed to have sometimes afforded shelter to Robert the First. An ordinary country congregation might easily find accommodation in it;

and one of the caves at Kilpatrick was actually used as a chapel some years ago, by a numerous body of the inhabitants, who separated themselves from the church, in consequence of entertaining some fanatical opinions similar to those held by the Rowites. A grave, composed of unhewn stones, deep, but too short for a person of ordinary size, is pointed out to strangers, on the farm of Drimadown, under the name of 'Fingal's sister.'

Machrie and the Black Water, in this district, are considerable rivers, and contain a good many salmon and sea trout in the proper season. A great proportion of the cultivated land, in this as well as in the last-described division, is inclosed, and in many places subdivided with stone walls and hedges. There are 1798 Scots acres of arable land. Limestone is found in various parts among the hills, but it is of difficult access and not very rich. In Clachen Glen, however, a considerable quantity is annually quarried and burnt for the use of the district.

5. *Lochranza District*—From Corrie round the north of the island to Auchnagallon on the west.

This district contains the group of lofty mountains which render Arran so conspicuous. The glens and corries are remarkably deep, dark, and rugged, and the great quantity of natural wood in various parts adds much to the beauty of the scenery. The arable land in this division is only 874 Scots acres. The soil is generally very light and sandy, and the hill-pasture indifferent, many of the mountains presenting nothing at the top, and for a considerable space below but bare rocks. The cultivated soil lies generally in narrow bands along the shores or rivers, and in some places on the coast there is no arable land at all, the hills rising almost immediately from the sea.

Lochranza, at the northern extremity of the island, is a very romantic place. It is a narrow valley, with a small rivulet running through it, and presents a most striking appearance,

seeming to be cut off from all communication with the other parts of the island excepting by sea. It has a safe harbour for small craft, and here the herring fishing is prosecuted with great vigour. The hills which bound the glen are so high, and approach so near to each other, that in winter the sun is never seen from some of the habitations. On a small peninsula, formed by the rivulet, stands a castellated ruin of considerable antiquity and size, and believed to have been a royal hunting-seat.

Sannox possesses great capabilities for a residence, with extensive pleasure grounds. The surface adjacent to the sea is beautifully varied and undulating, the heights and rocky knolls covered with natural oak and other trees. Two fine streams water and adorn the valleys, and the back ground is composed of lofty mountains with bold and serrated outlines. The deep and dark glen, receding far inland, has much of the appearance of the lower entrance of the celebrated Glenco; but the accompaniments of wood, water, and cultivated fields, are much finer in Glen Sannox.

Roofing-slates were formerly raised on the northern shoulder of this division, but were found to be of inferior quality. Blind or glance coal was also at one time worked at the sea, principally for the purpose of making salt from sea-water; but the seams being thin and difficult to be got at, the works were given up.

The narrow belt of land so frequently mentioned above, is continued round nearly the whole coast of this district. The scenery along the shores is bold, rugged, and varied, and the rocky ridge near the sea being often crowned with wood, many beautiful landscapes are presented. At the shore on North Sannox, at what is called the Fallen Rock, a scene of awful grandeur meets the traveller. Vast masses of rock appear as in the act of tumbling from a great height, and the beholder has some difficulty in believing that he is not involved in the ruins of a mountain falling upon him.

Climate.—Owing to the vicinity of the sea there is generally little frost in winter, and snow seldom lies on the low grounds. The spring and early part of summer are usually dry, and the summer months warm, but the extreme heat is tempered by the sea breeze. July and August are often sultry and moist; September, however, in most seasons, is a dry and warm month. At the south end of the island only a little more rain falls yearly than in the neighbourhood of Glasgow; but in the other parts it is believed the quantity is greater. The nearer to the high hills any place is, the more rain generally falls there. The winds are often strong and boisterous, coming from the hills in sudden gusts, sometimes accompanied with very heavy rains, which, however, generally do not last long, an entire day of rain very seldom occurring. The wind, when blowing gently on the side of the island opposite the direction in which it comes, often descends with great force on the other side.

Very little crop of any kind is raised at a greater elevation than a hundred feet above the sea, and it frequently happens that the corn and potatoes are much injured by violent gusts in autumn, even on some of the lowest land. This, with the occasional extremely heavy showers in summer and autumn, may be stated as the greatest disadvantage of our climate. On the whole, however, Arran has a mild and moderate climate; and were there more plantations to break the violence of the winds, these evils would most likely be little felt. It is worthy of record, that a year ago, in a population of less than four hundred persons, about Lamlash, there were sixteen individuals living, the average age of whom was $84\frac{1}{2}$ years, and not one of them was under 80.

In proof of the general mildness of the climate, it may be stated, that at Arran Castle and the White House, many plants of warmer regions stand the winter in the open air, such as geraniums, myrtles, three varieties of Fuchsia, the pomegranate, *Calceolaria rugosa*, *Passiflora cœrulea*, Camel-

lia, *Hydrangea hortensis*, *Magnolia grandiflora*, &c. Indeed, it is thought that the greater part of the ordinary greenhouse plants might, with a little care, be grown here in the open air.

Geology.—Few districts in Britain are more interesting in a geological point of view than Arran, which is annually visited by numbers of scientific travellers. It is composed principally of rocks of the primitive and transition classes. The Goatfell group is of granite. On its sides reposes a formation of the old red sandstone, covered more or less with sandstone of a later era. The more northern extremity is composed of mica-slate, clay-slate, greywacke, quartz, &c.; the southern, of trap in great variety, with sandstone reposing on it in various quarters, principally along the shores. The Holy Isle consists for the most part of basalt, the columns of which are pretty well defined, with sandstone also on several parts of the coast. Porphyry is found in many places: pitchstone is common, being exposed to view at Lamash, Mayish, Drimadown, &c. Trap and porphyry veins traverse the isle in all directions; and no person who examines them carefully can fail to come to the conclusion that they have been ejected from the bowels of the earth in a fluid state. In the Goatfell group rock-crystals occur in considerable quantities, some of them nearly black, but most of them brown of various shades, many also being transparent like glass. They are found adhering to the cavities in the granite rocks. There is some marble at the north end of the island, but it is not very beautiful. On this subject, reference may be made to the writings of Dr MacCulloch, and other geologists, who have given descriptions of this interesting island.

Zoology.—It is remarkable that in Arran there are no foxes, moles, badgers, polecats, stoats, nor weazels. The brown rat is abundant and very destructive. Red-deer were for-

merly abundant, and there is still a considerable number in the northern part of the island. A small kind of deer from America, of which a pair was introduced several years ago in the woods of Arran Castle, has thriven so well, that there are now more than thirty individuals grazing at large. Hares and rabbits are plentiful. The people of the district have a great liking to dogs, of which a large number is kept, principally of the colly kind. Cats, too, are very numerous, and often betake themselves to the hills and kill game.

Black and red grouse are very abundant; the former so much so as to be very destructive to the corn crops. There are a few ptarmigans on the mountains. Pheasants, which were introduced only a few years ago, are abundant in Brodick district. The ring-ouzel, the kingsfisher, and the golden-crested wren, are found in the island; and blackbirds, thrushes, chaffinches, sparrows, bulfinches, &c. are so very plentiful, that they destroy a great deal of the fruit and pease in the gardens. The Duke of Hamilton gives premiums for killing eagles, falcons, hawks, owls, ravens, hooded-crows, and magpies: these birds being nearly extirpated, the smaller kinds have increased so much as to be very troublesome.

The lakes and rivers abound in trouts and eels. Very few of the former are of the size of a herring. There were no minnows in Arran until lately, when they were brought from Ayrshire, it being expected that they will help to raise the trouts to a greater size. In July and August, when the rivers are swollen, sea-trout and salmon ascend. In Loch Jorsa especially, a great number of these fish is taken in autumn.

The sea abounds in fish, such as haddocks, whittings, cod, and mackerel. The herrings appear in their season occasionally in all parts of the Frith, and are generally most plentiful betwixt Arran and Kintyre. Some mullets were caught this season at Lamlash. Lobsters and crabs are numerous, as well as shell-fish, excepting oysters, of which there are a few at Lochranza. The following are the rarer species of shells

found along the coast : *Patella Clypeus*, *Bulla lignaria*, *Cingula labiosa*, *Scalaria Turtoni*, *Trochus Magus*, *Fusus cornus*, *Amphidesma pubescens*, *A. declive*, *A. compressum*, *Lucina flexuosa*, *Scalaria Clathrus*, *Tellina squalida*, *T. crassa*, *Venus fasciata*, *Venerupis virginea*, *Nucula Nucleus*, *Terebratula aurita*, *Astarte compressa*, *Venus Cassina*, *Cardium exiguum*, *C. medium*, *Pectunculus pilosus*.

Botany.—The botany of Arran is in general similar to that of other Highland districts. The following are some of the rarer plants, selected from a list kindly furnished by the Rev. David Landsborough, minister of Stevenston :—

Avena planiculmis. Goatfell.

Brassica Monensis. Brodick.

Carex pauciflora. Glen Sannox, Lochranza, &c.

Convolvulus Soldanella. Black-water Foot.

Cotyledon umbilicus. Lamlash, Sannox.

Carlina vulgaris. South-west coast.

Crambe maritima. Near Black-water Foot.

Cuscuta europæa. Lamlash.

Epipactis ensifolia. Whiting Bay, Brodick, Sannox, &c.

Epipactis pallens. Lochranza.

Hypericum elodes. Lochranza.

Habenaria albida. Sannox.

Juncus biglumis. Goatfell.

Lithospermum maritimum. Brodick.

Mentha gentilis. Lochranza.

Malaxis Loeselii. Between Brodick and Corrie.

Ænanthe pimpinello Near Springbank.

Osmunda regalis. King's Cove, Lochranza, Sannox.

Pinguicula lusitanica. Near Brodick, and other places.

Smyrniurn Olusatrum. Kildonan.

Sium repens. Near Lamlash.

Typha latifolia. Whiting Bay Mill-dam.

Roads and Harbours.—From Gorton Alister, a little to the south of Lamlash, an excellent road was made twenty-four years ago by the Parliamentary Commissioners, at the joint expense of Government and the Proprietors of Arran, leading to Brodick, and from thence to the sea at Black-water Foot, in the district of Shiskine, a distance of $17\frac{1}{2}$ miles. In 1821 and 1822, the Duke of Hamilton, entirely at his own expense, made a capital road, from the Parliamentary road near Lamlash, by the Ross-hill, Glenscorrodale, &c. to Bennicarrigan, fairly across the island. About the same time his Grace made a piece of road, about five miles long, at Kilpatrick, Auchencairn and Largybeg.

Previous to 1817, there may be said to have been no made roads in Arran, excepting the Parliamentary one above mentioned. In some places, indeed, attempts had been made to improve the tracks, but with little effect. By the law of Scotland, every man is bound to perform six days' work on the public roads yearly; but in most of the counties acts of Parliament have been obtained for converting the labour into an equivalent in money. Here, however, the people are yearly called upon to make or repair what are called the statute-labour roads, and as this is a public servitude not at all liked, the labour was negligently performed. When the overseers called out the people in their districts, instead of able-bodied men coming forward, there were generally only women, girls, and boys.

Shortly after 1817, however, it was judged advisable to appoint a skilful overseer on the roads of the Duke of Hamilton's property in the island. The people are now taken out in manageable numbers, and in one quarter or another are upon the roads nearly all the year, except seed-time and harvest. None but efficient persons are accepted as labourers, and absentees make a money payment according to a scale made up by the County Commissioners of Supply. From this source the overseer's wages are paid, and barrows and

other tools provided, the deficiency being made up by his Grace. Besides the statutory six days, each of the Duke's tenants, with his servants, is bound by bargain to work yearly three days on roads, harbours, embankments, &c. Since this plan has been adopted, great improvements have been made on the old roads, and many entirely new lines made; and should the present management continue for a few years, the roads in Arran will be generally as good as in any district of Scotland.

The harbours, of which there are four, viz. one at Corrie, one at Brodick, one at Black-water, and a fourth at Lamlash, are all small and defective, and vessels can get into them only at high water. Those at Brodick and Black-water were made by the Parliamentary Commissioners. The natural harbour at Lochranza is excellent for small sloops and wherries; and at Drimlabarra and Clauchog there are two little harbours, formed by whin-dykes or trap veins, which are of great use for small craft.

A good harbour, fit to admit vessels of moderate size at all times of the tide, is much wanted, either at Lamlash or Brodick, more especially now that steam-vessels visit the island. It is greatly to be regretted that the old harbour at Lamlash, on which Duchess Anne Hamilton spent L. 3000 more than a century ago, was destroyed by a person residing in Arran, who, professing to improve it, got leave to take down one of its sides, and employ the materials in building houses. The waves soon after demolished the other side.

Woods and Plantations.—Except in the Bay of Brodick, there is very little planted wood in the district, so that it has a naked and uncomfortable appearance, especially in the southern parts. Wherever trees have been planted, however, they have grown well. At Arran Castle there are many fine old trees, and extensive plantations of various ages, more or less having been planted yearly for a considerable time past.

There are 524 Scots acres of enclosed woods in the Bay of Brodick, principally around the castle. The kinds of forest trees planted are principally oak, ash, elm, sycamore, beech, larch, spruce, silver-fir, and Scots fir. A few horse-chestnuts and Spanish chestnuts, limes, poplars, walnuts, &c., have been planted in favourable situations. In order to enrich in some measure the appearance of the country, trees have been planted round every garden and stack-yard. At Corrie, Sannox, Mayish, Knockenkelly, and many places on the north and north-west sides of the island, there are considerable tracts of natural wood, consisting of oak, ash, mountain-ash, birch, hazel, and bird-cherry.

Population, Religion, Education, Character of the People.—
By the census of 1821, the population of

Kilmory Parish was	.	.	.	.	3827
Kilbride,	.	.	.	.	2714
					<hr/> 6541

In 1831, the population stood thus :

Kilmory,	.	.	.	.	3771
Kilbride,	.	.	.	.	2656
					<hr/> 6427

The decrease is accounted for in this manner : Great care was taken between these periods to prevent subletting and splitting the possessions ; and more than four hundred of the people, principally from Sannox, emigrated to Lower Canada and Chaleur Bay. Besides obtaining from Government free grants of 100 acres of land for each family, the Duke of Hamilton paid about half of the passage-money.

Almost the whole of the population belong to the Established Church of Scotland. A few (it is believed not more than a dozen) Independents have a meeting-house at Sannox. Upwards of twenty years ago, owing in a great degree to the encouragement given by the minister of one of the pa-

rishes, a great number of people were led to believe that their conversion must be instantaneous and palpable, and that the operations of the Holy Spirit should be as manifest now as in the time of the Apostles. The consequence was, that almost at every meeting, when a clergyman or other person, who they judged to have the Spirit, presided, great numbers, especially of women and children, were moved in a most extraordinary manner, uttering strange cries, trembling, and falling into convulsions, so that the service could not go on with regularity. Similar scenes sometimes occur yet, when clergymen supposed to favour their exhibition, conduct the services; but they are now less popular than they were. It is scarcely necessary to add, that these conversions produced no apparent good effects on the people.

There are two parishes in the island, Kilmory and Kilbride. At Shadog, in Shiskine District, there is a chapel built by the inhabitants, where the minister of Kilmory performs divine service on every third Saturday. Lochranza, too, has a chapel, to which there is a catechist, paid from a fund mortified by the family of Hamilton more than a century ago. He is not, however, ordained, which is felt as a great inconvenience in that district, so remote from any of the established clergymen of the country.

The minister of Kilmory has a stipend of fifteen chalders, half in barley and half in oatmeal; and the minister of Kilbride has seventeen chalders, also half meal and half barley. They have each, besides their stipends, L. 8 : 6 : 8 for communion elements yearly, with a manse and glebe.

Arran is better provided with schools than most of the Highland districts. There are six parochial, and three of the General Assembly of the Church of Scotland's schools; and there is one in the higher part of the district of Shiskine, under the patronage of the Society for promoting Religious Knowledge in the Highlands. All the children are now taught to read and write, and many of them learn some of

the higher branches of education. There are only a few of the old people that cannot read.

The Assembly's schools have been of inestimable benefit, both from the improved modes of teaching adopted in them, and the stimulus they have given to the other teachers. To Principal Baird, the Convener of the Committee of the Assembly's Schools, Arran lies under the greatest obligation; and it will give that patriotic gentleman pleasure to know that in this, as in many other places, his name is never mentioned, even by the poorest of the people, but with respect and gratitude. In the Assembly's schools, Gaelic as well as English is taught; but the sooner the former language is totally abolished the better.

In moral character the people of Arran resemble those of the inhabitants of other Highland districts. They are hospitable among themselves and to strangers. They are more confiding in each other than is altogether prudent. The money and other property of the more fortunate among them are freely lent to those in need, often when there is but a slight prospect of repayment. To their aged and infirm relations they are generally kind and dutiful, and scarcely any are ever allowed to beg their bread. The poor are supported by the collections made at the church doors, aided by small pensions given by the family of Hamilton, principally to old women.

The people of Arran may be justly described as a religious community. They have generally a competent knowledge of the leading principles of Christianity, mixed, however, with many superstitions, and not a little of what better informed people call fanaticism. Although generally honest in their dealings with one another, they frequently, like the Jews, think it no crime to get as much as they can from strangers, or those in a situation above them in rank. Many also feel an undue jealousy of the conduct and intentions of their su-

periors, and discover a cunning and art in prosecuting their little objects with those who they think can further them, that are often laughable, and sometimes shew considerable knowledge of human nature.

They generally marry young, often when they have provided but little with which to begin house-keeping. They are very frugal, live on the coarsest food, and often contrive to rear healthy families on means which appear very inadequate. Very few illegitimate children are born in the island; and although there are some customs among the young men and women that may appear inimical to chastity, self-control is certainly very much practised. They generally make good husbands and wives, and affectionate parents, very sober and attentive to their religious duties. So far as recollected, there is not a single native who can with justice be called a drunkard. Although the women perform a considerable portion of the out-door work in harvest and at peat-cutting time, they cannot be called drudges to the men. Formerly the people were much addicted to litigation, but there is now a marked improvement in this respect, very few cases being brought before the magistrates. Illicit distillation, which prevailed to a great extent, has now nearly altogether ceased.

The personal appearance of the Arran people is not such as we are accustomed to consider very good. They are generally short, strongly made, with coarse irregular features and high cheek-bones, the feet and limbs, especially of the females, very clumsy, the former being large and flat, the ankles thick, and the heel projecting considerably beyond the limb. Black is the prevailing colour of the hair. They are very polite and insinuating in their address, and rarely exhibit those awkward and boorish manners so common on the mainland. To their superiors they shew great respect, so much so, indeed, that it is sometimes annoying. Yet, though even a little in excess, such conduct is more pleasant to wit-

ness than the very reverse, so often to be met with in the more improved parts of the kingdom.

Even so late as seventeen years ago, the females, when at church, were coarsely dressed, often in home-made clothes; the unmarried with a ribbon or band on the head, the married with a close cap. Now, the young women dress in calicoes and muslins, some of them in silks, and wear straw or Leghorn bonnets. The matrons still prefer the close cap.

In this district, the people are exceedingly superstitious. They firmly believe in the power of the "evil eye," in apparitions of many different kinds, and in charms for healing diseases. Few dare to travel alone at night for fear of ghosts, and they are terribly in dread of a kind of spirit which they call the "white sack," which is said to be in fact a full white sack rolling on the ground!

State of Property, Husbandry, Rural Management.—The Hon. Mrs Westenra holds in property ten small farms on the north-west side of the island, renting, on an average, at about L.50 each. The arable land on these farms extends to about 755 Scots acres. For the last fifty years, very little change has taken place on these lands, except that more potatoes are cultivated; the houses are of the rudest description; the cattle and sheep diminutive; and the land is cultivated in the most slovenly manner, generally by runrig.

John Fullarton, Esq. of Kilmichael, possesses the farm of Whitefarlane, on the north-west side of Arran, containing about 138 Scots acres of arable land, and 30 acres of natural wood. It is occupied by a number of tenants, who work the land in common, and jointly pay a rent of about L.110. It is much in the situation of the lands above mentioned. This gentleman also possesses Kilmichael, on which there were, in 1808, 57 Scots acres of arable land, and $2\frac{1}{2}$ acres under wood. The extent of both, however, is now considerably in-

creased, as he has greatly improved the place, which he farms and occupies himself.

The Duke of Hamilton is proprietor of the whole of the remainder of Arran, the Holy Isle, and Pladda. The arable land of his Grace's portion, by the last survey made prior to 1813, was 10,228 Scots acres, but must now amount to some hundreds of acres more. The property is let in 458 farms or possessions, of which fifty-three are pretty large; the rest small possessions of from two to forty acres. The present rental is L.10,000, not including the castle, garden, some grass-parks adjoining, and the Whitehouse, garden, and parks.

Previous to 1815, this property was divided into 113 farms, each of which was occupied by several, generally from four to twelve, tenants, on the common or runrig system; and the management was such as was followed in other remote districts of the Highlands. The common rotation of cropping was, on the infield, or croftland, oats, oats, pease and a few potatoes, bigg with dung, and again oats, &c. On the stronger land, beans took the place of pease. The soil was never cleared of weeds, which, even when the ground was under beans or potatoes, were merely covered over for a little time in summer, but not extirpated. The outfield was sown with oats, the crops immediately succeeding each other, as often as it was judged that they would produce a little more grain than was used as seed, and after that allowed to lie covered with weeds for some years. No improvement could be expected to follow this mode of managing the soil. Little fodder was raised, and as no grass-seeds were sown, there was no hay; turnips, as food for cattle, were quite unknown in the island; in short, no other winter food than straw was provided for the cattle and horses.

Above what were called the head-dikes, the cattle, sheep, goats, and horses ranged in common over the whole extent of the island; and the tenant who was able, sent more cattle to

the hills in summer than he could provide for in winter. The consequence was, that numbers of cattle, and even some horses, died annually; and those that survived were generally in spring in that state of starvation provincially termed "lifting." A great number of the male horses, cattle, and sheep, were not castrated, and roved over the mountains in all directions. Many of the young were therefore produced at improper seasons, and many became mothers at too early an age.

Fifty years ago, the very few potatoes that were cultivated were all planted by the Highland spade, in lazy-beds; for it was then thought that they would not succeed otherwise. Those that remained undug at the end of the season, were covered with fern and stones, and lifted as they were required. The farming utensils were of the coarsest and most unwieldy description; the plough short in the stilts, with an unshapely beam, and with no other iron-work than a sole-plate, coulter, and sock, the latter much too large; the harrows entirely of wood. The plough was drawn by six horses, harnessed with ropes, birch twigs, and rushes.

The dwellings of the tenants were built of rough stones, the walls plastered with a little clay in the inside, thatched in a very imperfect manner with fern or heath, without vents or windows, and divided internally by a single partition formed of watlings smeared with clay. The whole house was open above the partition from end to end, there being no cielings or lofts of any kind.

In 1815, however, a great change was effected in the manner of occupying and managing the lands, to which the people, as generally happens in similar circumstances, were at first very averse. Several moderately large farms, from 100 to 400 arable acres each, were let on nineteen years' leases to tenants from more improved districts. These were interspersed among the small possessions, as examples to the tenants in general of better cultivation than that to which they had been accustomed. A number of farms fitted for the

rearing of sheep and cattle were let to tenants of the island, who possessed more capital and enterprise than their neighbours. Excellent steadings were built by the proprietor on these farms, and march and division fences made, partly at his expense, and partly at that of the tenants.

The remainder of the property, consisting of lots of various sizes, with some little exception, was let in general on fourteen years' leases, but where great improvement was required, for nineteen years, to the people of the island, each lot to one tenant, or in a few cases to two. They were bound to build suitable houses on situations pointed out, for which they in general received one year's rent, timber and lime from the proprietor. They were also bound to inclose the arable land with ditches and hedges, his Grace furnishing the plants. The hill pasture was generally given to the tenants of the low lands, to graze their cattle in common.

The system of culture prescribed to all the tenants was, in general terms, that two corn crops were not to be taken in immediate succession, that a green crop sufficiently manured must always be betwixt the corn ones, and that grass-seeds must be sown along with the corn crop which directly followed the green hoed crop. They were also bound to bring into cultivation, in a stated time, the waste land on their possessions, by removing baulks, cairns, and brushwood, and by draining where necessary. Sheep were expressly prohibited, except on the stock farms; goats were put away, as troublesome and unprofitable; and swine, which by this time had become extremely numerous, were not allowed to range at large.

For a number of years, as might be expected, many of the tenants of the smaller possessions very imperfectly fulfilled the obligations under which they had come, in regard to the management of the land; but comparatively good houses were erected, the fences in general were made with surprising dispatch, and a great deal of waste land was cultivated.

In 1821, in order to encourage the tenants to improve their possessions, his Grace agreed to pay the expense of bringing into cultivation by spade labour such portions of the waste land as might be pointed out by the agent on the island, the tenants performing the labour. This was continued for several years, and was productive of good effects. It improved the appearance of the country, added to the productive soil, and accustomed the people to handle the spade. From L. 300 to L. 900 yearly were laid out in this way. The same plan was also followed afterwards in draining.

In 1829, the possessors of the smaller lots generally got new leases, in which it was stipulated that the proprietor was to have it in his power to point out where the drains were to be made, and to be at the expense of cutting them, but the tenants were to build and fill them with stones at their own cost. In the few last seasons, upwards of thirty miles of excellent drains have been yearly made. They are generally done on Elkington's principle, that is, by cutting off the springs at their sources, and are generally from three to six feet deep.

In bringing under the plough moorish land near the hills, the tenants adopt a plan, which, though neither new nor singular, has succeeded well. They plough the land in spring, turning up a very thin furrow, which lies till it is very dry in summer, when it is collected into heaps, burnt, and the ashes spread on the soil. The ground thus prepared is ploughed in spring and sown with oats. On the moss, a different culture is generally used. It is in the first place drained, then dug, and so remains a year; then a second digging is given, and potatoes are planted, with sea-weed or stable dung. Oats are generally sown next year, but sometimes bigg.

Ever since 1815, the improvement of the property has gone on progressively, but during the last seven years with increased speed. Many of the small possessions have been converted into farms of greater size, and as they were let only

for seven years at Martinmas 1828, it is probable that this plan will be carried still farther next year ; so that at no very distant period, the whole possessions on the estate may be expected to be moderately-sized farms, keeping from two to six horses.

The people, since each enjoyed a possession which he might call his own, have steadily advanced in habits of industry, and though in this respect they are still behind the tenants and labourers of the mainland, it is believed that in no Highland district is greater industry shewn than in Arran.

There are now a number of large possessions enclosed, subdivided, and well cultivated, having fine stocks of cattle and comfortable farm-steadings, where formerly there were numerous huts without chimneys or windows, and ridges running in all directions without a single enclosure or subdivision. The general rotation, except on the shores, is, 1. Oats ; 2. Green crop—potatoes, turnips, beans, or pease, with manure ; 3. Bigg, wheat, or oats, often manured ; 4. Hay ; 5. Pasture grass ; 6. Pasture, sometimes grass a year or two longer. On the shores and holms, the rotation is, 1, Oats ; 2, Green Crop ; 3. Bigg or wheat—these often with manure ; 4. Hay ; and then oats, &c. again. These rotations are not always adhered to by the tenants having the small possessions, but they all now sow grass-seeds with the corn crop which succeeds the green one, and this of itself necessarily leads to better management than they formerly practised. Wheat to a considerable extent has for a few years past been raised by the tenants of the larger possessions, and a great number of the small tenants also grow from half an acre to two acres each of that grain.

By these changes in the mode of possession, and by the improvement of the soil, it will easily be comprehended that more and better cattle can now be reared and supported than formerly, and that the produce of those milked is much greater. Ever since 1822, the Duke has supplied good Argyllshire bulls at his own expense, for the cattle on his property, keep-

ing always in the island from twenty to thirty, and placing them here and there at convenient distances. The consequence of this arrangement is, that the cattle have been surprisingly improved in every respect. On a few of the larger farms, excellent stocks of Ayrshire dairy cows are kept, and succeed very well.

Even so late as seventeen years ago, the sheep were almost all of the small white-faced sort ; now, they are almost entirely of the black-faced kind, and nearly of the usual weight of that breed. The introduction and improvement of this race were greatly forwarded by the premiums given for rams by the Highland Society. One tenant has crossed the black-faced sheep with Cheviot rams, the produce of which has fully answered his expectations. The horses also have been greatly improved both in size and appearance, and few ponies of small size are now to be seen.

An active spirit of improvement pervades all classes. A Farmers' Society, having upwards of sixty members, has been five years established, and gives premiums for ploughing, sown grasses, turnips, neat cottages, brood-mares, colts and fillies, queys, ewes, swine, &c. The emulation thus excited is great, and it may be noticed that since the ploughing matches commenced, great numbers of iron ploughs, principally made by Wilkie, have been brought to the island, even by the occupiers of the small lots.

It is by no means, however, intended to represent the rural management of the island as perfect, for much remains to be done ; but as the prejudices of the people are fast giving way, it may reasonably be expected that the march of improvement will henceforward be very quick. The young men and women go in considerable numbers yearly to Ayrshire to service, from whence they generally return, anxious in some degree to adopt the modes of management practised in that country.

The yearly exports cannot be given with perfect accuracy ; but the following statement is a pretty near approximation.

152 *Mr Paterson's Account of the Island of Arran.*

900 Black cattle at L. 3 : 10 : 0,	-	-	L.3150
450 Swine at L. 1 : 10 : 0,	-	-	600
Fowls and eggs,	-	-	700
Sheep and wool,	-	-	2500
Bigg, 2500 quarters, at 26s.	-	-	3250
Wheat, 700 bolls, at 24s.	-	-	840
Beans and pease, 900 bolls, at 16s.	-	-	720
Oats, in grain and meal, 3000 quarters at 20s.	-	-	3,000
Potatoes, 3000 bolls, at 10s.	-	-	1, 00
Herrings caught by 100 wherries, at L.40 per wherry,	-	-	4,000
Butter and cheese,	-	-	1,000
Shellfish, about	-	-	100
Freestone and limestone,	-	-	500
			<hr/>
			L.21,860

A good deal of money comes into the island from the wages of small tenants' sons and daughters who go to the mainland as servants, and give the greater portion to their parents. The Ayrshire people like the Arran lads and lasses very well as servants, as they are much more respectful to their employers than the same class in that country. There are no manufacturing establishments; but a great number of the women and young girls embroider and vein for the manufacturers. There is plenty of carpenters, smiths, shoemakers, tailors, milliners, and shopkeepers. The greater part of the clothes worn by the men, and a considerable portion of those of the women, are spun and woven here.

There are two corn-mills, one at Brodick, the other at She-dog. At Brodick and Burican there are two wool-carding mills, and a flax-mill was erected some years ago at the latter place. A legal distillery has been in operation at Torrylin for several years past, which makes spirits nearly equal to the famous Arran Water.

Miscellaneous Observations.—The alterations in the manner of occupying the lands were not effected without great opposition from the people, who threw every possible impe-

diment short of actual physical resistance in the way; and had the Duke, and those acting under him, not been perfectly satisfied that what they did was for the benefit of all parties, they must have stopped short of the end contemplated. To his Grace, therefore, and to Mr Brown, his agent at Hamilton, who is believed to have concocted this scheme, great praise is due. Nor has this nobleman made only one great effort to improve his estate; the amelioration is yearly going on with a considerable outlay of money. It must always be unpleasant to a proprietor to dispossess any of his tenants, and happily in Arran, though the change may be called radical, not very many of the tenantry were left without land.

The planting of forest trees, previous to the accession of the present Duke to the management, had been greatly neglected. He has made at least four-fifths of all the plantations; but wood is still greatly required both for shelter and ornament.

There are a few things which might be done at no very great expense, that would, in the humble opinion of the writer of these pages, be extremely beneficial to Arran, and hasten the progress of improvement.

In the *first* place, leases from fifteen to nineteen years should be given to all the tenants, excepting perhaps the small cottars about the villages, and the occupiers of the houses there. As in many parts the ridges are not straightened, and as this is generally an expensive operation, it might be made a clause in the bargains that are soon to be made with the small tenants, that, provided the arable land in the possession of any one of them be all properly straightened by a fixed time, the duration of his lease will be a certain number of years, say five, longer than the term named in his missive or tack.

Secondly, Arran being a favourite place of resort, were building leases granted for villas to some extent, at Brodick, Lamlash, and elsewhere, a great many would certainly be built. The advantages of this would be great. At present

there is not business for a steam-vessel to run regularly in winter betwixt Arran and the mainland ; but were a number of villas tenanted by wealthy people, there can be no doubt that steamers would ply summer and winter, especially were there a harbour to which access could be had at all times of the tide.

Thirdly, Various bridges are wanted in the island ; one especially over Slidderie-water seems to be absolutely necessary.

The inhabitants of all wild and elevated regions seem to have a peculiar attachment to their native land. That the Highlanders of Scotland feel the love of country very strongly is unquestionable, and that it has a beneficial effect on their moral conduct is as certain. The dread of being expelled from Arran, has more efficacy in restraining those of its inhabitants who may be inclined to dishonest, vicious, or idle courses, than all the penal laws in force ; and when a stranger marries a woman of the island, the couple are never at rest till they acquire a settlement in the native place of the wife.

The very limited bounds prescribed to the above account of a very romantic and interesting part of the West Highlands, have prevented the writer from going so much into detail as he wished to have done. To do justice to the district, a large volume, in place of a brief paper, would be requisite.

3d October 1834.

REPORTS RELATIVE TO PLANTATIONS.

[The Society's Gold Medal has been given to each of the authors of the following reports, conformably to the intimation that it would be conferred on the Proprietor, who in any year communicated a satisfactory Report on the planting of land, and who had accordingly, within a period of five years preceding the date of his report, planted on his own property an extent of not less than one hundred and fifty acres.]

1. *Report relative to Plantations made on the Estates of Skibo, in the County of Sutherland.* By GEORGE DEMPSTER, Esq. of Skibo.

On these estates there have been planted, within the last five years, 1116½ acres, as certified by Mr Shand, surveyor in Tain, who has measured the ground. The quantity of trees planted amounts to nearly three millions, viz. from Messrs Dicksons, Brothers, 2,339,900, and a quantity not less the 600,000 raised, or otherwise obtained by Mr Peter Ferrier, gardener at Skibo.

The plantations are in number fourteen, of very unequal sizes. Three of them are continuous, and form an extent of 851½ acres. The whole enclosed extent of this great plantation is in fact 873 acres ; but as about 21 acres are still unplanted, I have of course been unable to claim for them. It consists of a range of rocky moor, rising from the north bank of the Dornoch Frith, immediately above Bonar Bridge. It is admirably adapted for plantations, and has accordingly been planted chiefly with larch ; also with hard wood of all sorts in the hollows and burn-sides, and spruces and birches in the more spongy places ; and with clumps of holly here and there. The northern part is almost entirely planted with Scotch fir. The soil of this tract of land is various ; but is commonly that sort of gravelly soil so general in the North Highlands. A good deal of mossy ground, on which the trees can hardly be expected to grow so well, is interspersed.

Above a million and a half of larches have been planted, which is equal to about one-half of the whole quantity used ; and I can report that they are making rapid progress, so much so as to confirm my resolution of making this tree the principal one in all my future plantations. I have been in the habit of planting two years' seedling larches indifferently with those of one year transplanted, which I was induced to do on account of their cheapness ; and they have answered with me equally well.

I have planted 800,000 Scotch firs, also two years' seedlings ; and the remaining 700,000 plants consist of various sorts of forest trees and spruces ; viz. oaks raised from English acorns, sycamore, ash, elm, birch, holly, &c.

I have enclosed, as far as possible, with a substantial stone wall, five feet or more in height. Where stone was less easily procured, and where the adjoining land was less occupied by tenantry, a high substantial turf-dike, with hood, ditch, and one or two rows of whins sown on the top inside, has been substituted, it having been found in former plantations to answer well.

I have, where necessary, and where it could be done, made a good many small drains previous to planting ; and this practice I should strongly recommend in all situations where it may be necessary. I have also, in all places where the heath was old and long, had it burnt ; but this should always be done one year before planting, and not the previous summer, particularly in very dry situations. The rate of planting has been somewhat less than 3000 plants to the acre, and I think this on the whole is what I shall continue to make my average.

The expense of plants, enclosing substantially, draining, preparing, and planting, I cannot state at less than a guinea an acre.

Of the other plantations, three are almost entirely fir, three entirely larch, one partly oak partly larch, with spruce intermingled ; all the rest are mixed plantations.

Instead of adding any general observations on the principles and practice of planting, I beg to say that the account by Mr William Shiells, of his management of the Duke of Atholl's plantations, published at Edinburgh in 1831, appears to me by far the best manual to be followed by proprietors of lands adapted for plantation. I entirely agree with him in all his ideas, and differ only with respect to my own experience as to the expense. But for this I account by considering that the Duke of Atholl's great and constant system of planting, enabled him to accomplish it cheaper than could be done by smaller proprietors.

I will only add my entire conviction of the advantages, present and future, arising to the country and to individuals, from a continuation of the system of planting which has already done so much for Scotland. The amelioration of the climate, the improvement of the soil and pasture, the convenience to the poorer population, the profit to the richer, the independence and defence of the country ; every consideration in short, only impresses more deeply on my mind the conviction that the Scottish landholder acts at once a prudent and a patriotic part, when he covers his barren acres with wood.

6th November 1834.

2. *Report relative to Plantations on the Estate of Kilcoy, Ross-shire.* BY COLIN MACKENZIE, Esq. of Kilcoy.

As a competitor for the honorary premium given by the Highland and Agricultural Society of Scotland, I beg to submit the following report of the plantations made by me within the last five years. In that period, previous to October 1834, I have planted one hundred and eighty-five imperial acres chiefly with Scotch fir from Norwegian seed, larch, and oak ; the number of plants to an acre averaging, of Scotch fir 4000, of larch 3500 ; the former two-year old seedlings, which I have invariably found to answer best, the latter one year transplanted, or two years, if the ground was rough. The oaks I

planted chiefly in deep ravines or on burn sides, where the soil was alluvial in part, and the shelter good, without which latter I never found them to succeed well. I have also planted a good many hardwood and ornamental trees along the plantation-walls and road-sides, as well as in clumps. The oaks I generally rear myself, sowing each year about 20 bushels of acorns. One year I sowed 70 bushels, for the planting out of which as a copse-wood I had a good many years ago the honour of receiving a premium from the Society. The oaks I plant out at the ages of three, four or five years transplanted, according to the nature of the ground, always pitting them, and seeing the pits carefully dug, the roots properly surrounded with earth, and a divided turf pressed down over all, the distance between the plants being from three to five feet. The Scotch fir I also principally rear myself, sowing annually from 30 lb. to 40 lb. of seed. The larch I generally purchase; though I sow about 10 lb. if the seed be good, I seldom have half an average crop.

I one year calculated the expense of the oaks I planted out, including the price of acorns and management. It amounted to L. 85; and I found that the same number of plants of the same ages, if purchased from a nursery in the neighbourhood, would have stood me about L. 355. When my own nurseries are not sufficient to complete my plantations in any one year, I frequently purchase one-year transplanted larches when cheap, putting them out in lines for a year before planting them.

In all grounds not overrun with tall heath or broom, I always find the above ages to succeed best. The distances between the Scotch fir and larch plants I vary, according to the ground, from three to four feet. They are all dibbled in with the spade. I put the larches thicker on the dry hillocks, except on the extreme ridges, where I plant firs as affording better shelter.

The soil is in general excellent, being clay or clayey loam,

with a subsoil not too retentive, and a freestone bottom. The climate also is good, there being just a sufficiency of rain. I may mention that this very year I observed several shoots of larch from three to four feet in length.

My enclosures are chiefly turf at first, $5\frac{1}{2}$ feet high, or 5 feet after subsiding, including the two top-turfs. These are sufficiently fencible, with occasional repairs, till the trees are beyond danger; but in very exposed situations I sow furze or whin seed at the bottom of the wall inside, which in three or four years makes a fence, when properly cut like a hawthorn hedge, which no animal can penetrate, and will protect the plantation even if the turf-wall should fail. Should it be necessary afterwards to enclose the plantation with stone, so as to keep cattle within it, I calculate that the interest saved between the times of erecting the turf and the stone walls will equal the prime cost, and suffice to build the stone fence. I knew an instance in which a fir plantation was surrounded by a stone wall that cost L. 1500, where for twenty or perhaps twenty-five years, one of turf would have been equally efficient. The interest of the money expended, and which would have sufficed to build a stone-wall, might have been saved, had a turf one been originally built.

The turf-walls are built at 2d. per running yard. The planting is done chiefly by women, who plant, and children, who hold the plants; the former receiving 6d., the latter 4d. per day.

I am a great advocate for planting, as an improvement which, at the smallest cost or outlay, yields the greatest return; and besides being ornamental, improves the soil, by adding to it decomposed vegetable matter; and ameliorates the climate, by preventing the bad effects of currents and eddies of wind, or sudden blasts. It is also one of the few modes by which a landlord can add any thing to his income, beyond his mere rent-roll.

Larch is certainly the quickest-growing and most useful

plantation ; but the Scotch fir also pays well, and is likely to do so still better, as less of it is now planted, while as prop-wood for coal-mines it must always be in demand ; and our props are most usefully exchanged with our southern neighbours for their coal and lime, while our plantations are necessarily improved in growth by the additional air afforded by the thinings.

I have omitted to mention that, when the ground is wet, I cut small drains previous to planting ; and should any seem necessary afterwards, I employ a few boys, while engaged in the planting, to make a cut with the spade, to lead the surface water into the drains.

I may conclude with stating, that the season before the commencement of the five years to which the premium is limited, I had completed an enclosure of above 200 acres, and some years before another of several hundred acres ; and that, during this winter and the ensuing spring, it is my intention to plant 166 imperial acres, most of which is already walled, and for which I have, all ready, either in my own nurseries or bespoken elsewhere. After this, I shall still have remaining in nursery the Scotch fir and larch of last year's sowing, and about two acres under oak, over and above last year's acorns.

DESCRIPTION OF MR HUNTER'S PATENT STONE-PLANING MACHINE.

THIS highly ingenious machine, which is now employed in the pavement quarries of Leys Mill, Forfarshire, the property of Lindsay Carnegie, Esq. of Kinblethmont, for the purpose of dressing stone by a process of planing, has for several years been gradually and steadily acquiring that perfection which it now possesses, and of which the first notice was brought before the Society about six months ago. At that time the in-

formation respecting the machine was not so complete as to warrant its publication, but in order to obtain this in a satisfactory manner, the Directors appointed a local committee to examine the machine in operation, and to report. This committee accordingly met at the works, and having satisfied themselves on every particular, they submitted the following report to the Directors :—

Report of a Committee on Mr Hunter's Stone-planing Machine.

The Local Committee appointed at a meeting of the Directors of the Highland and Agricultural Society of Scotland, held on the 19th day of June 1835, having, in terms of the remit to them, assembled in Leys Mill Quarries and Stone-works, in the parish of St Vigean's and county of Forfar, the property of William Fullerton Lindsay Carnegie, Esq. of Boysack and Kinblethmont, to inspect Mr Hunter's patent stone-planing machine, worked by a steam-engine, and applied to the dressing of pavement stone,—and having seen the same in full operation, beg leave to report thereupon as follows:—

Understanding that a particular plan and description of the machine, as prepared by Mr Kerr, engineer in Dundee, is in readiness, and will be immediately submitted to the Society, your committee consider it unnecessary to enter into any details relative to the machine itself, and in this report they confine themselves to the expression of their perfect approbation of its construction and efficiency.

With reference to the statements contained in a letter, of date the 10th day of June current, from Mr Lindsay Carnegie to the secretary of your Society, your committee are fully convinced that these statements are borne out by facts, and they submit, as the result of their own personal observations, the following facts.

There were put upon the bed of the machine at the same time, three pavement stones in a rough state, and of unequal

162 *Description of Mr Hunter's Stone-planing Machine.*

thicknesses, the first of which contained $12\frac{1}{2}$ superficial feet, requiring to be reduced two inches in thickness ; the second containing $16\frac{1}{2}$ superficial feet, and to be reduced one inch and a quarter ; and the third containing 18 superficial feet, and to be reduced three quarters of an inch. The whole of these stones, amounting to 47 superficial feet, were reduced and polished by the machine in thirty minutes, including in this the time occupied in shifting the irons.

Your committee beg farther to state, that with a view of comparing the working of the machine with hand labour, they interrogated Mr Donald Mackay, master mason and builder in Arbroath, who stated that to have accomplished the same work in the ordinary way by the hand, would have occupied a good mason five days and a half, at a cost of 15s. 9d., according to the present rate of wages in this part of the country ; whereas, according to the calculations submitted by Mr Lindsay Carnegie, in his letter to the secretary above referred to, and which your committee have every reason to believe correct, the expense would amount to about 1s. 7d.

In addition to the trial above noticed, your Committee saw stones of a harder quality from different quarries in the county dressed by the machine, with a corresponding advantage ; and your Committee cannot close this report, without expressing their conviction of the great advantages to be derived from the extended operation of Mr Hunter's machine, as being the means of preparing for the market as pavement, a quality of stone which, without its assistance, could never be turned to account ; as well as effecting a very great saving by its application to the dressing of all kinds of freestone, usually employed for hewn work, in particular in large works, such as harbours, piers, bridges, &c.

Your Committee beg leave also to report, that, by the same steam power, they saw in operation the same principle applied as an experiment to a turning-machine, from which they are satisfied that it may be applied with economy and

advantage to the turning of stone vases and other ornamental work.

At Leys Mill, the 29th June 1835.

DAVID CARNEGIE.

J. W. HAWKINS.

W. D. PROCTOR.

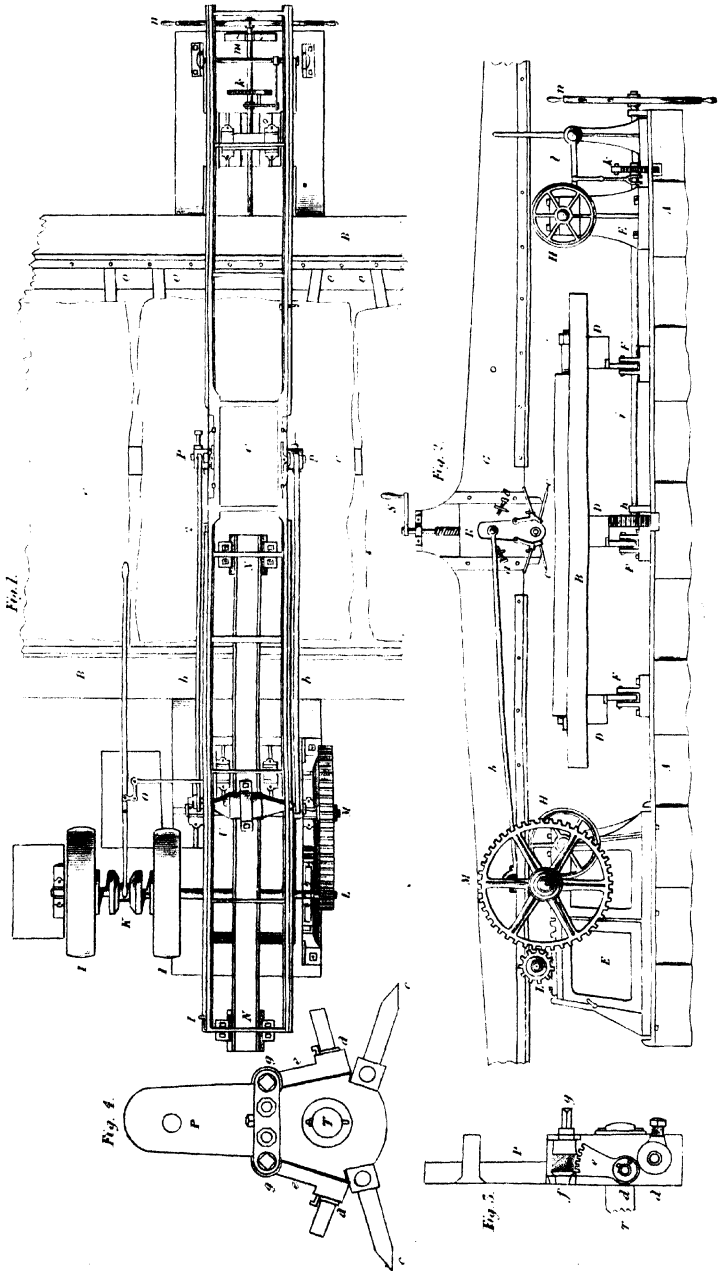
JOHN MILLAR.

Such being the result of the observations made by the Committee, affording the most satisfactory evidence of the efficiency in operation, and the great saving effected in the expense of dressing stone, it remains only to give a short description of the machine which is illustrated in Plate III. Fig. 1. represents a plan of the machine as it appears ready for work, with a part of three stones lying upon the platform, (which is here broken off at both ends), in readiness to be acted upon when the machine is put in motion. Fig. 2. is an end elevation of the machine, the same letters of reference applying to both figures. AA is the sole or foundation plate. B a traversing platform of 4-inch plank, on which the stones are laid to be dressed. CCC are three of the stones, the platform being capable of containing more or less according to size. DDD are three longitudinal beams, to which the planking of the platform is bolted. EE are heads or standards supporting the different parts of the gearing. FFF are three sets of rollers, on which the platform traverses. G is the reciprocating carriage or tool-frame, to which the planing tools are attached. HH rollers on which the tool-frame traverses to the extent of 6 feet or 3 feet on each side of the central position represented in the figure. II are two pulleys, one of which is driven by an open strap, and the other by a cross strap from the same drum, and connected with the impelling power. These pulleys, by means of the intermediate clutch K, acting on the one and the other of the pulleys alternately, gives the reciprocating motion to the tool-frame. A pinion L is fixed upon the same shaft with

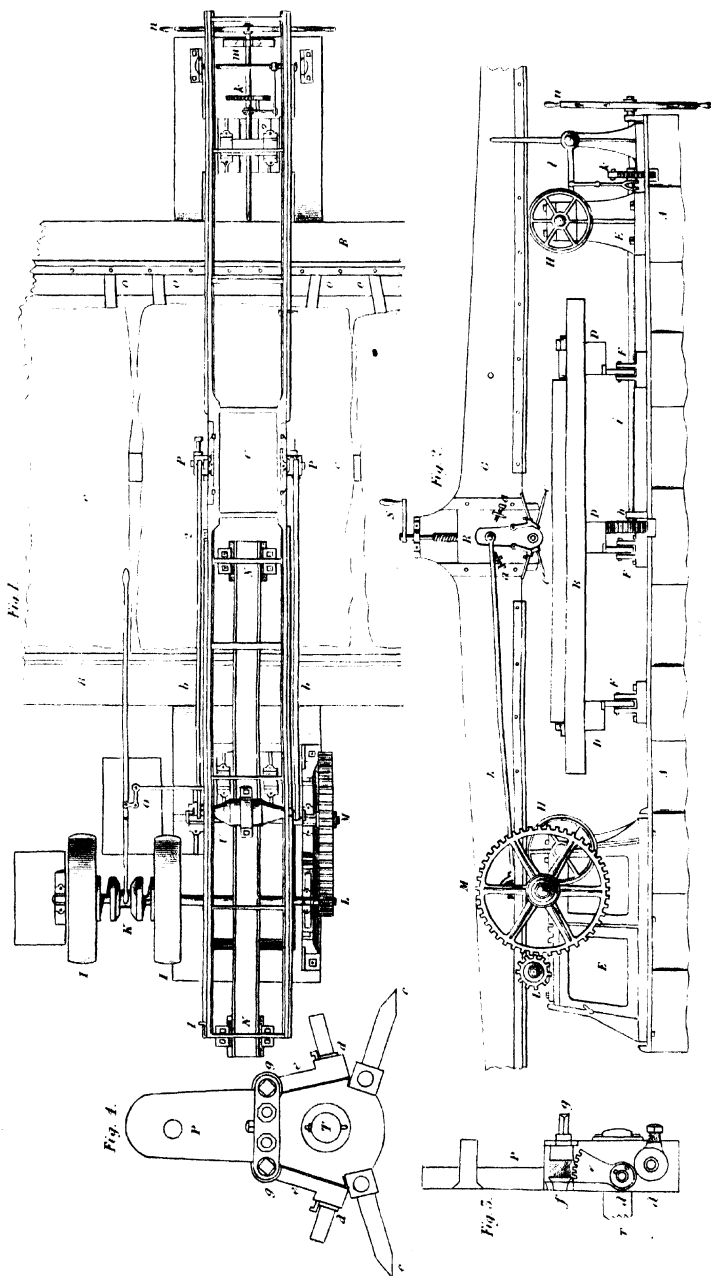
164 *Description of Mr Hunter's Stone-planing Machine.*

the pulleys, and works in the spur-wheel M. Upon the shaft of this wheel another pinion, not seen in the figure, is fixed, situate under and acting upon the rack marked N. This train of gearing gives motion to the tool-frame, the reciprocating motion being kept up by the two studs 1 and 2, in the side of the frame, acting upon the crank and lever O of the clutch. In the middle of the tool-frame, and on each side of it, are attached the cant-blocks P, shewn in figs. 3. and 4. on a larger scale. These are moveable on strong studs fixed in the sliding blocks R, adapted to have a vertical motion produced by turning the handle S, serving to regulate the depth to which the tools are to be applied on the stones. The cant-blocks have an angular motion, on the studs 'T', regulated in extent by the pinching screws *aa*. The angular motion is produced by the connecting rods *bb*, which are brought into action at the commencement of each stroke, by being in contact with the ends of the beam U attached to the back of the rack, and projecting through the sides of the tool-frame. The rack being so joined with the connecting-rods *bb*, and being so constructed as to have liberty to slide a short space before putting the tool-frame in motion, the first effect of the rack in each stroke is to cant the tool-blocks PP, which, depressing the point of the tools *cc* alternately, makes the machine cut in both directions. The cutting tools are securely fixed into the cases *d*, figs. 3. and 4, with keys and pinching screws; those on one side are puncheons or roughing tools, while on the other side of the frame they are chisel-shaped. To prevent the chisels from running the work into furrows by one of their angles being lower than the other, an adjustment has been adopted, simple and effective, by which these finishing tools are adjusted with precision in the transverse direction. This is effected by means of the apparatus shewn in figs. 3. and 4, where *e* is a toothed segment fixed on the end of the case or tube which holds the tool. The edge of the segment is toothed, and adapted to the screw *f*. This last is turned by a small handle or key *g*, and the tubes in which these chisel too's

HUNTERS STONE PLACING MACHINE



HUNTERS STONE PLAINING MACHINE



are set being moveable in their sockets, they are capable of easy and accurate adjustment to the plane of the surface upon which they are acting.

The apparatus for traversing the stone platform is situated at the end of the machine opposite to that which gives motion to the tool-frame. It consists, as already noticed, of the platform with its supporting beams and friction rollers. To the lower side of the central beam is attached a rack, acted upon by the pinion *h*, placed upon the shaft *i*, towards the farther end of which is fixed the ratchet-wheel *k*. The ratchet is fitted with a pall and crank *l*, mounted on a separate shaft *m*. The crank, at every return of the tool-frame, is pushed back by a pin set in the side thereof, which, drawing up the pall moves the ratchet-wheel, when, its connected pinion *h*, acting in the rack of the platform, brings the latter forward a space for the next cut of the tools. By means of the spoke-wheel *n*, which is mounted on the same shaft with the ratchet and the pinion *h*, the platform is thrown entirely back, when all the stones upon it have been planed, or is returned under the planing tools, if any part of the work requires to be gone over a second time. The stones are kept in their places on the platform by small quoins or wedges *o o*, driven between their edges and a parallel bar, fixed on either side of the platform.

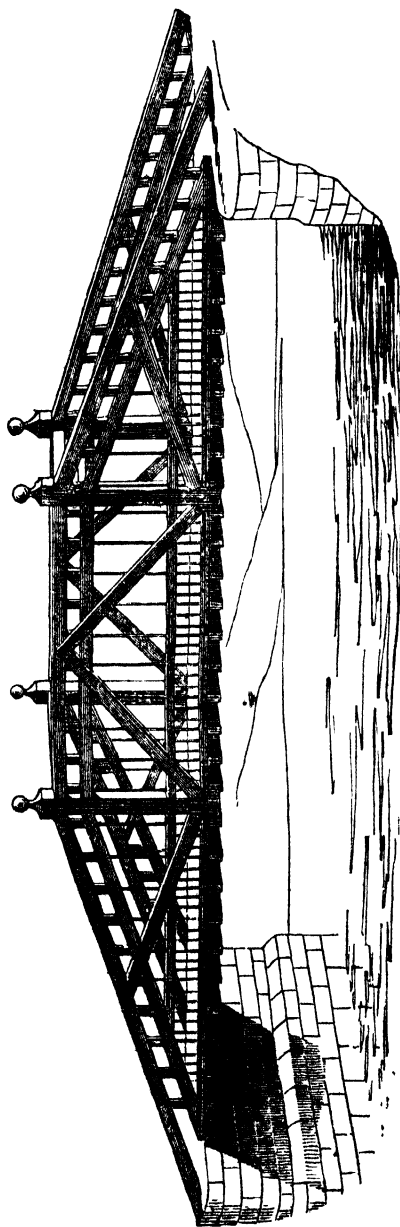
The tool-frame generally traverses at the rate of thirty feet per minute, and a set of stones filling the platform from end to end can be planed in about forty-five minutes.

A principal feature of the invention appears to consist in the means provided for so adjusting the roughing-tools that they shall strike the stone, not upon the surface, but at such a depth below it that the surface is driven off in large portions at a time; much less waste is thereby produced on the tools than if applied to the surface, an object of the highest importance in all stone-cutting machines, and which has been overlooked in all previous attempts.

DESCRIPTION OF A BRIDGE OF SUSPENSION. *Constructed by
Mr JOHN YOUNG of Brechin.*

THIS bridge, represented by the accompanying cut, is constructed on the principles of suspension, and was erected by Mr Young in 1814, over the North Esk, in the parish of Lochlee, Forfarshire. From the testimony of gentlemen resident in the neighbourhood, it appears that the bridge has answered every purpose for which it was intended, and remains now in a perfectly serviceable condition after a lapse of twenty-one years, during which period it has withstood the shock of many a flood, particularly that of 1829, when bridges of stone, of wood, and of iron, were swept away. During a certain period of this great flood the roadway of this bridge was submerged to the depth of several feet and escaped without injury; thus affording a proof that it possessed the important principles of strength and stability.

The construction of this fabric is very simple, as will appear from inspection of the annexed isometrical figure. The span is 100 feet, the width over all at the middle is 14 feet. The roadway is suspended from two wooden trusses, one being placed on each side. The trusses are connected to each other over head by frame-work, producing thereby greater steadiness in the lateral direction, while the height under the cross framing is sufficient to allow the passage of loaded carriages. Vertical suspending-rods of iron are passed through the beams of the trusses, descending to, and passing through, the ends of the roadway-beams, each of which is supported by a suspending-rod at both ends. The feet of the trusses are received into cast-iron shoes, and all the joinings are strengthened with the same material. The planking of the roadway is laid longitudinally, and when bolted to the beams forms one entire plank, affording at the same time a tie to the trusses resisting the longitudinal thrust, and reducing the whole strain on the abutments to a vertical pressure, serving every purpose of lateral trussing to prevent resilience in that



direction. The dimensions of the principal parts of this bridge are; the main beams of the trusses 14 inches by 7 inches; roading beams 14 inches by 7 inches; planking of roadway 3 inches thick; suspending rods $1\frac{1}{4}$ inch diameter of malleable-iron; and the total expense L. 245.

Note.—The advantages of bridges on this principle, combining the appliance of wood and iron, seem to be; 1st, The giving an entire clear water-way up to the roadway-beams; 2d, By using timber chiefly in the form of struts, and malleable iron in that of ties, the smallest possible quantity of materials consistent with a due degree of strength will be sufficient; 3d, From the two foregoing, a minimum of expense for the whole will be obtained.

The disadvantages may be stated as, 1st, The perishable nature of timber as compared with the iron, producing decay sooner than if the structure were either entirely of stone or of iron; 2d, The cross strain that must necessarily follow the application of suspending-rods attached at various points throughout the length of the beams or struts of a wooden truss, those at the connecting points only of the truss being applied, so as to produce longitudinal compression on the struts, while all the others produce less or more cross-straining; * 3d, The longitudinal planking of the roadway, though forming a good main tie, is yet deficient in principle; a bar of malleable iron attached to the cast-iron shoes, into which the feet of the trusses are stepped, would be more efficient, and the bottom of the suspending-rods would be more substantially secured to it than to the beams, while the ends of these would rest upon the bar. *

* In chain-bridges on the suspension principle this defect is obviated by the suspension being effected from those points only where the chain-bars are connected to each other consecutively by very short links; hence the load in such structures is supported entirely by tension, and altogether free from cross-straining; the constant tendency of the latter, to cripple or derange the fabric into which it enters, ought to be carefully avoided by the engineer and the architect.—C.

NOTICE ON THE GEOLOGICAL SURVEYS.

[THE Highland and Agricultural Society of Scotland, fully convinced of the vast importance to national prosperity in general, and especially to rural economy, of a knowledge of the solid materials on which different soils rest, some time ago offered very liberal premiums for geological surveys and descriptions of various parts of this kingdom.

It is scarcely requisite to point out the advantage to the public and to individual proprietors of the discovery of seams of coal, of veins of the useful metals, or of quarries of slate and limestone. It is also well known, that immense sums have occasionally been expended in attempts to discover those valuable materials in situations where a small share of geological information would have foreseen that there was no rational hope of success. Accurate geological reports of various districts are the first steps to disseminate sound views on such subjects; and if the efforts of the Society can contribute either to the discovery of valuable mineral productions, or prevent the expenditure of capital on such hopeless schemes, there can be no doubt, that the attainment of these objects is highly deserving of its encouragement.

This, however, is not the whole value of geological researches. An acquaintance with the composition and arrangement of the great mineral masses on which the soil reposes, is immediately advantageous to agriculture. It is universally admitted, that to constitute a good soil, carbonaceous matter must be mingled with certain proportions of siliceous, argillaceous, and calcareous particles, and that these elements are chiefly derived from the disintegration of the subjacent rocks. Hence an

accurate knowledge of the rocky basis will often indicate the probable value of the superincumbent soil, and in many instances points out to the agriculturist which element is defective, or most requisite for the improvement of his land. Thus, it is well known, that rocks, affording by decomposition a stiff clay, require an intermixture of sand to render the soil more pervious to moisture, and of lime to afford a salutary stimulus to vegetation. On the other hand, a soil resting on limestone will seldom be improved by lime as a manure: the strong, tenacious clay arising from the decomposition of whinstone often forms an excellent soil when treated with quicklime or shell sand: a sandy soil, especially if resting on freestone, will require the addition, not of a pure calcareous earth, but of an argillaceous lime, or of clay marl, in which clay is the predominant ingredient: and few soils can bear a large quantity of magnesian limestone as a manure, without serious detriment to vegetation.

The successful practice of irrigation and of draining is greatly influenced by the nature of the substratum of the soil, and depends in no small measure on the dip and direction of the subjacent strata; while the profitable cultivation of various sorts of grain and grasses is materially affected by elevation above the sea,—circumstances which form an important part of every geological survey.

Having thus briefly indicated the intimate connexion between Agriculture and Geology, we commence a series of surveys of districts in Scotland with the first prize Essay "*On the Geology of Berwickshire*," for which the sum of Fifty Sovereigns was awarded in 1835."]

A GEOLOGICAL SURVEY OF BERWICKSHIRE. *By DAVID MILNE, Esq. Advocate, Edinburgh.*

THE following survey has been drawn up in answer to the call which has been made, and the premium offered, by the Highland and Agricultural Society of Scotland, for a correct geological description, “from actual observations,”—“of any county or district in Scotland,”—“corresponding to an extent of surface of not less than 200 square miles.”

The district which has been selected with this view, is the county of Berwick;—a district extremely varied and complex in its geological relations, and well fitted to illustrate that intimate connection between the sciences of geology and agriculture which it is the object of the Society to demonstrate, and of which it is itself the appropriate emblem. Of the richness and fertility of the soils of Berwickshire, it is unnecessary to premise even a single remark, because the luxuriance of its crops, and the small proportion of waste to arable land within its limits, are unequivocal and acknowledged proofs of it. Nor is its importance as an *agricultural* county more remarkable, than the number of interesting and intricate problems which it presents to the *geologist*. On it, as the field of combat for the discovery of physical truth, have the most distinguished philosophers of the last half century contended. How many spots are there, among the hills of Lammermuir, which cannot be contemplated without awakening recollection of the labours and zeal, and profound researches of a Hutton, a Playfair, and a Hall,—who have described these localities in their works, and pointed to them as the proofs and strongholds of the Huttonian theory! The complicated and mysterious foldings of the greywacke strata at Fast Castle,—the junction of the transition and secondary rocks at the Siccar Point,—the enormous masses of conglomerate which gird the base of the Lammermuirs,—are all familiar to geologists, as having afforded to those great men materials for speculation and inquiry, which enabled them

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to give to the world the first glimpse of the vast revolutions and changes which our globe has undergone, as well as an insight into those secret and powerful agents by which these revolutions were effected.

But it is not on this account only that the eye of the geologist rests with interest on the district we now purpose to describe. It has, within these few years, again become the field of research and controversy regarding new points of difficulty, which the present advanced state of the science has suggested. Several geologists from the sister kingdom have lately examined and furnished reports of small portions of the district. Mr Winch has written a paper on the red sandstone rocks which he met with on the banks of the Tweed. Mr Witham discovered some interesting fossils in two localities, of which he published accounts; and a paper was read at the meeting of the British Association for the advancement of Science, at Edinburgh in 1834, which gave an *outline*, but professed to give only an outline, of some of the most interesting features of the district. No *complete* or *detailed* survey has been compiled and given to the public, of the geology and mineralogy of the *whole* district; nor, least of all, has any attempt been made to explain the "relation existing between the richness and fertility of its soils, and the rock formations,"* from which these soils are derived. For the Highland and Agricultural Society of Scotland the duty and the honour was reserved,—(and to no institution could that duty and that honour more fitly belong), of directing the attention of geologists to these interesting and useful subjects, and of presenting incentives to the execution of the task, as well as of affording facilities to the publication of reports worthy of that distinction, which must necessarily be attended with the happiest effects. Of the immense advancement which will thus be given to *geology* in Scotland, and of the progress which will be made in the discovery of those mighty changes which have marked the former history of our globe, nothing

* Terms of the Highland Society's advertisement.

need be said. But who can foresee the advantages which will thence result even to *agriculture* itself, when the operations of husbandry, are guided by a knowledge of the rocks that produce by their disintegration the soil from which our crops are raised, and on whose texture, position, and altitude,—the character of the climate so greatly depends?

Geography.—It is proper to point out the extent, boundaries, and principal geographical features of the district whose rock formations are to be described. This may be done in a few words;—more especially if the coloured map which accompanies this survey, be looked at, from time to time.*

The district to be described forms very nearly a *square*, each of whose sides is on an average about twenty-two or twenty-three miles long. If a line be drawn from the mouth of the Tweed nearly south-west to a point a little to the south of the Eildon Hills; thence north-west to Soutra Hill; and from the last point, in a north-easterly direction, to the mouth of Dunglass Burn, we shall have traced very nearly the inland boundaries of Berwickshire; the fourth side of the district being washed by the German Ocean. The space contained within these limits comprehends about 500 square miles.

The geographical *appearance* of the county of Berwick may be conceived, by noticing on the map that its north and west boundaries run along a chain of greywacke hills, which, on the north, separate the valley of the Tweed from the plains of East Lothian, and on the west run parallel to the Leader which flows through Lauderdale. These two chains of hills rise to no great height above the sea, being on an average not more than 1200 feet, and never exceeding 1700 feet. The district slopes down gradually from the eastmost half of the north boundary to the valley of the Tweed, which skirts its south-

* The map here referred to is the large folio edition of Thomson's map of Berwickshire, a copy of which, coloured so as to mark the different formations, was lodged with the Essay. It has been found impossible to attach so large a map to this volume; but it is hoped that the reduced map which the reader will find hereto appended, may be found sufficiently intelligible.

ern boundary ; but, farther west, the slope is broken by a number of isolated trap hills, which are unconnected with the greywacke ranges, and which in general do not rise higher than 800 feet above the sea, though some of them are as high as 1200.*

The chief river of the district is the Tweed, which flows in a north-easterly direction, and, within the district, is joined by five rivers from the north, viz. the Leader, Eden, Leet, Blackadder, and Whitadder, and by two rivers from the south, viz. the Teviot and Till. It will thus be seen, that the line of the great valley of the Tweed is nearly parallel to the Lammermuir chain of hills, which forms the northern boundary of Berwickshire.

Geology.—The rock formations of this, as of most other districts, may be conveniently divided into *aqueous* and *igneous* rocks, a phraseology which seems more suitable to this district than *stratified* and *unstratified*,—inasmuch as it will be found, that there are trap-rocks in the district which are stratified as completely as rocks of a different character.

I. *The aqueous rock formations* of Berwickshire comprehend at least three distinct series, viz. the greywacke rocks, the coal-measures, and the red sandstones ; including among the last named the old and the new red, *both* of which, there seems reason to think, occur in the district.

1. The *greywacke* rocks in Berwickshire are found only on its north and western sides. The extent and southern boundary of this formation are indicated on the accompanying map by a *blue* colour. The Lammermuir chain, which runs from St Abb's Head to the west, may be on average about ten miles broad, and therefore comprizes about 220 square miles of horizontal surface.

The greywacke range, which forms the western boundary

* The heights of all the principal hills in the district will be found marked in the map accompanying this memoir. Most of these heights were calculated by the author from observations with a sympleometer.

of the district, is intersected for the greater part of its course, as is seen on the map, by the valley of Lauderdale. Between the hills are numerous ravines, which pour their torrents into the Leader water that joins the Tweed three miles below Melrose.

The greywacke rocks in this district consist of an aluminous or argillaceous sandstone. It is generally of a light greenish-blue colour, but occasionally it is reddish-brown. They are of two kinds, the one kind consisting of thin slaty beds, and the other of thick compact strata. The texture is generally that technically termed "fine granular," the particles of which the rock is composed being seldom larger than those of sea-sand. Occasionally a few grains of mica are interspersed through the rock; and sometimes small nodules of greenish clay, about the size of a hazel or a walnut, are met with. Some strata occur of a black argillaceous colour, much intersected with veins of calcareous spar. These may be seen at the south side of Soutra Hill, near the old road, and on the banks of the Ale Water, in the parish of Coldingham. They are a coarse kind of alum-slate.

The greywacke strata are found, in nine cases out of ten, to be vertical, and to run nearly due east and west. It is unnecessary to mention localities in proof of this observation, for there are few spots where it cannot be verified. At Earlston, at Chapple, at Dodd's Mill, at Ordweel, at Soutra, and at most places where the strata can be observed, they present the same uniformity in their dip and direction. There are, however, some exceptions to the general rule; as at Ayton, where they dip E. N. E. at $\leq 50^\circ$. About a mile above Ayton they dip E. S. E. at $\leq 60^\circ$. At Renton, they dip N. $\frac{1}{2}$ W. at \leq of 65° . About $1\frac{1}{2}$ miles north of Ayton, the greywacke strata are vertical, running in the same direction. At Colbrands-path Tower they dip S. S. E. at \leq of 80° . At Netherbyres near Eyemouth they dip about south at \leq of 70° .; and at Longformacus they dip to the north at \leq of 60° .

But whilst, generally speaking, the greywacke strata of Berwickshire run east and west, and are nearly vertical,—in some

places they *fold over one another* in every imaginable manner. The bold cliffs between Burnmouth and Eyemouth, and the still loftier precipices at St Abb's Head, present the most interesting and perplexing sections of these twistings and foldings. They are, generally speaking, found most abundant, and most fantastic, among the strata which have a slaty structure. Pile a number of carpets over one another horizontally, and then elevate the whole mass, by pushing the two opposite sides towards each other,—the central parts will fall and fold over, and if cut across, would present a multitude of convolutions and twistings. This homely illustration not unaptly represents the stratification of the greywacke rocks at St Abb's Head, at Dodd's Mill, at Eyemouth, and on the Tweed near the Flybridge; but the comparison fails in one respect, when we reflect on the immense weight and small tenacity of solid strata of rock, in consequence of which the contortions, fractures, and dislocations, become a thousand times more frequent and complex.

That these strata could not always have been in the extraordinary attitudes and positions in which we now behold them, it requires little reflection to be convinced of. For both experience and reasoning assure us, that all rocks which are stratified, and of sedimentary origin, as the greywacke rocks undoubtedly are, have been originally in regular and parallel layers, at the bottom of a sea in which they were deposited. The mind, when once satisfied of this fact, naturally and eagerly springs to the inquiry, *how* these prodigious and appalling changes have been brought about;—changes by which strata of immeasurable thickness, which were once horizontal in the depths of a former ocean, have not only been raised out of these depths, and to the height of thousands of feet above the level of our present sea, but have been, as it were, driven and dashed against one another, so as to present nothing now but a scene of inextricable confusion. It is the business of the geologist to understand and to interpret these phenomena, forming, as they do, the language in which the operations of Nature are recorded;—and out of the apparent confusion

which prevails, to unravel and reveal to mankind the age of our planet, and the epochs that have marked its eventful history.

But these are *speculative* inquiries, from which we, in *this* part of our survey, entirely abstain. Nothing tends so much to diminish the value of *facts* as data in the investigation of truth, as a propensity to theorize, before we have gathered all that observation can give us, or an attempt to rest satisfied with particular facts, whenever they support preconceived opinions. Any attempt to explain the various phenomena which are exhibited in the different rock formations, and still more any attempt to trace the various cataclysms and catastrophes to which our globe has been subjected, we *reserve* to a subsequent part of this memoir,—after we have given a correct, full, and faithful account of the different formations by which the district is characterized. It is enough at present to have *hinted* at the existence of phenomena to be unravelled, and revolutions to be ascertained; for then we become the more disposed to search for information in every possible quarter,—to concentrate every glimmering of light that can be discerned,—and diligently to study that volume of Nature, from which alone we can learn what are the agents that have been instrumental in fashioning our globe into what we now find it,—so wonderfully and benevolently adjusted to the constitution and habits of the animal and vegetable creation, which now occupies its surface.

But—to return from this digression, to a continuation of our account of the greywacke rocks, it is obvious from what has just been said, that it would have been most desirable to have discovered in them some *organic fossil remains*, that we might have known something of the state of the animal creation when these rocks were formed. There seems in this district to be a total absence of any such remains. That there did exist, however, various crustaceous and molluscous animals in the waters of that epoch, as well as *plants* of several kinds, is made known to us by the examination of the greywacke rocks in Aberdeenshire, Wales, and other parts of the European

continent. But much yet remains to be done in the investigation of the Lammermuir greywacke; for however assiduous and long continued may be the researches of one geologist only, with his little hammer, among vast ranges of hills, it is obviously impossible to say, especially where the rocks do not happen to be extensively quarried, that no such imbedded fossils anywhere exist. The inquiry is of importance in this respect, that if the *absence* of all vegetable and animal *exuvia* be confirmed, the inferences would seem to be, in the 1st place, That the bed of the sea in which these rocks were deposited was farther from dry land than its plants and shrubs were drifted to; and, in the 2d place, That the sea in these parts was too deep, or possessed some other condition which rendered it unfit for the existence of marine animals.

There are various contents in these rocks, such as metals and minerals, which will more properly be afterwards described, when we treat of the *mineralogy* of the district. They are not noticed here, because none of them are peculiar to the greywacke rocks.

It is for the same reason that we do not stop at present to describe the various trap-rocks which appear among these greywacke strata. It is sufficient to state at present the *fact*, that igneous rocks are found in considerable abundance among the Lammermuir Hills; and those which the author has noticed are betokened on the map by *green* colours. These trap-rocks exist in such abundance among the greywacke measures, as to constitute nearly one-sixth of the whole, and they form a subject of most interesting study; for it is one of the problems which presents itself for solution, whether it was by these trap-rocks that the greywacke range was *elevated*, or whether they have burst out at *succeeding* or *preceding* periods. But this is obviously one of those questions which we cannot in *this* place discuss; and which indeed we are not fitted to understand, until we have made ourselves fully acquainted with the character, the positions, and the effect of these respective rocks on each other.

We may, however, here observe, that some of the phenomena which we meet with in the greywacke rocks cannot be rightly understood without reference to the trap-rocks in their immediate vicinity. For example, at Fassney, where the sienitic greenstone appears, the effect of the trap has been, to render the greywacke in contact with it so compact, as to give it the appearance of a greenstone. At Netherbyres, the greywacke strata have been folded over one another—apparently by trap which is immediately in contact with them, and by which they have been lifted up, and so softened, as to have sunk down and folded over. Fig. 1. Plate IV. may give some idea of this curious section, *aaa* representing flat sheets of greywacke strata, inclined at an angle of about 70° to the trap hill of Highlaws, which begins to rise from this spot; *bbb* are the outer surfaces of one of the foldings. The trap, though not seen below and in connection with these strata, is not far off, for it is quarried near the top of the hill; and the idea is at once suggested, that the greywacke has been raised by the igneous rock, on which it is now apparently resting, and then, when softened by the heat, partially slipped down, and produced the arches it now exhibits. The span of the arch, of which *b, b, b*, mark the outer coats, is about eight feet.

Though we have ventured to suggest the above explanation of the section just described, it must be admitted, that it may be either refuted or confirmed by farther examination, especially of those parts where the trap and greywacke are in contact. The locality has been noticed, not for the purpose of introducing a solution, which the author is convinced is the true one, but chiefly for the sake of affording an example of the foldings common among the greywacke strata, and of observing on the caution which is necessary in forming theories to account for particular appearances, because, undoubtedly, foldings of the strata exactly similar to the above, may be seen in many other places, near which there are no trap-rocks at all.

Before leaving the greywacke strata it is proper to remark, that in many parts of the Lammermuir chain, numerous rents, slips, and fractures occur, which in some places may be traced to a great extent and a prodigious depth. Two instances may be taken from opposite sides of the Lammermuir range, the one at Cockburn Mill in the parish of Preston, and the other near Colbrandspath in the parish of that name.

At Cockburn Mill, the greywacke strata dip N. W. by W. at an angle of 75° . It is here overlapped by a red conglomerate; but, at the spot referred to in Fig. 2, Plate IV, the bed of conglomerate has been broken across, and the lower part *c* is now between thirty and forty feet separate from the upper part *c'*. There can be no doubt that the upper and the lower bed have originally formed one continuous stratum, so that, since its deposition, either the greywacke strata *g'* have been pushed up, or the strata *g* have slipped down on the surface of the others, about thirty or forty feet. It may be added, in reference to the dip of the greywacke rocks at this spot, which is different from what is usually observed in the series, that the trap-rocks of Cockburn Law are within a quarter of a mile of them to the north-west; so that, if we may venture in this place to theorize at all, we might easily find one cause at least sufficient to have thrown these greywacke rocks over to the south, and caused those at *g* to slip down the face of the now inferior rocks.

Fig. 3, Plate IV, is meant to represent a section of the greywacke rocks in the burn (Heriot Water), which runs past Coldbrandspath Tower, and in that part of its course between the tower and the sea. The greywacke at *g* dip here to the S.S.E. at an angle of 70° , but at *g'* they dip at an angle of about 45° . The conglomerate beds, which rest on the edges of the greywacke rocks, dip to the north, and form nearly a right angle with the latter. Above both beds of conglomerate there are thin slaty strata of red sandstone;—the sandstone at *s'*, however, at their lower ends, resting apparently on the upper surfaces of the greywacke at *g*. Now, it is ex-

tremely probable, that the two conglomerate beds *c* and *c'*, have been originally one bed, and that a slip has taken place to the extent of several hundred feet down the surface of the rocks at *g*. The conglomerate at *c'* is about fifty feet thick.*

A *third* example of a slip may be given from the Siccar Point, which is so celebrated on account of the junction it presents between the greywacke and more modern rocks. Fig. 4 is a sketch of the Siccar, viewed from the south. *S* is the sea, and *B* is the beach. *G G'* are strata of greywacke rising vertically out of the water (and capped by *c*, a bed of red conglomerate), and *R, R*, numerous strata of red sand-stones. These red sandstones dip towards the sea, at an angle of about 20°. The bank above the beach at *B* consists of numerous beds of red sandstones *R'*, identical with those marked *R*, in colour, in thickness, in structure, and in every other respect, except their dip to the sea, which is far greater than the others. Moreover, they are united at the top of the bank, whilst, at the level of the beach, they are about eighty feet below those at *R*. That the strata *R'* and the strata *R* have been originally continuous, there can be little doubt; and, therefore, to account for this appearance, we must suppose that the greywacke strata, by which the sandstones at *R'* were supported, have sunk or slipped down the smooth sides of the greywacke strata *G, G'*, which yet support the other sandstones at *R*. The great depth of the sea, close to the latter strata between the beach and the point, favours this supposition.

In these instances, the slips are pretty clearly established by the testimony afforded by the beds of conglomerate and red sandstone which the slips have broken and separated. But there are other places where the occurrence of such slips, as well as rents, is equally well established without such aid. A few of these may now be noticed.

The first that may be noticed is one that seems connected

* This figure is on much too small a scale.

with the slip at Siccar. A deep gully or ravine winds for about two miles from that point, in a north-westerly direction towards the Pease Burn mouth, where it is met by another and still deeper ravine, over which the celebrated Pease Bridge was thrown many years ago. The commencement of this ravine may be observed about 200 yards west of the bay at Siccar Point, and it runs past the ruins of St Helen's Church. In some places the ravine is about 100 feet deep; generally speaking, the strata are vertical, and form great walls on each side, whose smooth surfaces favour the idea of, as they would have furnished facility to, a slip and separation of the strata. This gully is perfectly dry; and there are no symptoms of any stream or current of water having ever flowed in it.

The ravine now described runs across the neck of a piece of land which projects into the sea, and which is perhaps not more than three miles in circumference. Taking a bird's eye view of the whole spot, the idea strongly suggests itself of this peninsula having fallen away, as it were, from the rest of the greywacke hills, which tower above it, and thus produced the valley in question.

The ravine, at the bottom of which the Pease Burn runs, is still more remarkable. The depth of this ravine is, on an average, for about two miles of its course, 150 feet.* During the lower half of its course, and, in particular, for some hundred yards below the Pease Bridge, the sides of the ravine are nearly perpendicular, and not more than fifty feet, in some places only twenty, apart. To suppose that the tiny brook which now flows at the bottom of this ravine could have cut through and worn down the compact greywacke rocks to such a depth, is impossible; and no alternative is left but to attribute the formation of the ravine to a rent or fracture which took place at a former period in this part of the earth's crust. About one and a half miles north of St Abb's Head, is another rent or fissure, which forms a deep

* The Pease Bridge is 123 feet above the burn; but it is not built at the highest part of the ravine.

and gaping indentation in the precipitous cliffs on the shore. Its depth (measured by the sympiesometer), was found to be 311 feet, and it runs for 250 yards inland; farther than this it cannot be traced, on account of the chasm being filled up with alluvial soil. This fissure, at its mouth, at the edge of the sea cliff, is about forty yards wide, and becomes gradually narrower towards the land. No burn runs in it.

A still larger ravine, of the same kind, may be seen between the farms of Dulaw and Lumsden. It is about half a mile in length, exceeds 100 feet in depth, and is about forty feet wide. In several places the sides or smooth faces of the strata are parallel with the course of the ravine. A burn of insignificant size runs through part of it.

Another example of such rents may be seen between Eyemouth and Ayton. The river Eye now runs in it.

It only remains further to be added, that the greywacke strata are quarried for various purposes. The thicker strata afford pretty good materials for building; and most of the farm-houses in the Lammermuirs are constructed of them. The more slaty kind has been tried for roofing; and on the Boon Water, about two miles above Spottiswood, several quarries may still be seen, where it was worked by the father of the present proprietor for slating his farm-offices. But it is not so compact as the Easdale slates; and, consequently, it much more easily absorbs moisture, and suffers from the frost.

It is proper to mention, that on the accompanying map the author has marked all the quarries which he noticed in the district. They are indicated by a Δ .

2. The next formation which we proceed to describe is the *old red sandstone*, to which we have already more than once alluded, in our account of the greywacke series. In fact, it is equally impossible and inexpedient to give an account of any one formation without describing its relations to those with which it may be in contact; for, in every department of

scientific research, far more danger arises by attempting to form opinions on limited and partial views, than by taking a large and comprehensive survey.

The old red sandstones form the intervening link between the coal-measures and the greywacke. They pass so gradually and imperceptibly into the former, that it is difficult to fix on the exact line of demarcation, the strata of both formations being entirely conformable to one another, though they differ in some important respects to be immediately specified. But there is no such gradual transition of the old red sandstones into the greywacke. It has been already seen that, at the places above mentioned, where the junctions of the two formations is visible, the conglomerate and sandstone beds rest on the upturned edges of the greywacke strata.

This formation consists of strata of red flesh-coloured sandstones, and it generally rests on a conglomerate basis,—the conglomerate consisting of rounded fragments of older rocks. The conglomerate varies exceedingly in thickness. In the Heriot Water, below Colbrandspath Tower, its thickness is about fifty feet. In the little bay south of the revenue station at Red Heugh (near Fast Castle), the conglomerate is between twenty and thirty feet thick. At Cockburn Mill, already described, it is about the same thickness; but in other places, as on the north side of Soutra,—near Woodcot,—among the sources of Monynut and Dunglass Burn,—and among the Lammermuir Hills, it exceeds in thickness 100 feet.

The strata of sandstone which overlie the conglomerate, vary very much in texture. They appear to possess a slaty structure in the lower part of the formation, and to increase in solidity and hardness as they rise towards the upper parts.

There are many beautiful displays of these old red sandstone rocks,—for example, on the Blackadder River between Preston and Cockburn Mill, on the sea-shore between Dunglass Burn and the Pease Burn, and on the banks of several rivulets, which descend from Soutra near Blackshells.

The ~~first~~ two of these localities may be described.

About a quarter of a mile below the bridge at Preston, the coal-measures are seen dipping to the S. E., consisting of blue shales, sandstones with vegetable remains, and thin beds of limestone. Before, however, we have walked fifty yards above Preston Bridge, we find a change in the formations. There the red sandstone rock dips down to the eastward at an angle of about 40°. It is speckled over with round white patches, and is between twenty and thirty feet thick. It is hard enough to be capable of being used for building, and, in fact, seems to have been at this spot formerly quarried. From under these sandstone rocks, numerous beds of a soft, friable, and slaty texture rise, having the same deep red colour. These rocks continue up the river for about half a mile, preserving nearly the same dip and direction. There, however, the dip and direction suddenly alter, in consequence of a trap-dike which crosses the river, the dip being changed to the N. E. at an angle of 70°. Traps of various kinds then occupy the channel and banks for some distance, after which the red sandstone again becomes visible, dipping as before to the eastward at an angle of 50°, and marked with white blotches. They continue for about a mile farther, as far as Cockburn Mill, where the conglomerate appears, forming a bed about 100 feet thick, and resting on the upturned edges of the greywacke. It there dips S. $\frac{1}{2}$ E. at an angle of about 30°.

The rocks at the mouth of Dunglass Burn belong to the coal-measures, consisting of thick beds of yellow and red, or brownish-coloured sandstones, with vegetable remains, strata of encrinal limestone, and beds of shale. In walking along the shore, we are struck with the enormous masses of coarse sandstone, which form the cliffs, and the immense quantity of iron with which they are impregnated. The iron not only gives a colour—a red brownish colour—to the mass, but occurs also in *veins* and thick nodules, which stand out in ragged

and amorphous shapes, the rocks having been weathered away around them. The rocks dip at a small angle, till we get within a quarter of a mile of the Cove, when they begin to rise more abruptly; and, at this point, we suddenly lose and leave behind the shales, and limestones, and dark coloured sandstones. At the Cove the flesh-coloured red rocks make their appearance, rising towards the S. W. at a steeper angle, and they continue gradually increasing in dip all the way to the Pease Burn mouth, where they rise at an angle of 70° or 80° . These red sandstones are not nearly so coarse in their texture as the rocks of the coal-measures at Dunglass. The colour is a brighter red, as if the iron were in a state of peroxide; and they are marked with the characteristic white spots which they possess at Preston. The conglomerate, it has been already mentioned, is seen in contact with the greywacke in Heriot Water, about 200 yards below the old tower. Another point where a junction may be seen is in the Pease Burn, about half a mile from its mouth; but at this latter spot there is little or no conglomerate interposed. The red sandstone strata are themselves resting on the greywacke strata.

These red sandstone strata, it is well known, have been the subject of much difference of opinion among geologists. They have been visited, examined, and hammered, by Hutton, Playfair, and Hall,—Buckland, Jameson, Sedgwick, and Murchison, as well as by many others of less celebrity. Most of these authors have recorded and published the views and opinions they entertain concerning them, and to these it is unnecessary to advert. But it may not be out of place to refer to an inspection of these rocks by Sedgwick and Murchison, made in the autumn of 1834, the result of which has never been made known to the public. These eminent and experienced geologists were desirous of visiting some of those celebrated spots, of which they had so often read in the controversial writings which the Huttonian theory called forth; and after the meeting of the British Association at Edinburgh, they set out together from Dunglass to examine the Siccar,

and contemplate the complex stratifications of Fast Castle. They visited, on their way thither, the red flesh-coloured rocks at the Cove; and, at first, Professor Sedgwick expressed a strong conviction that they belonged to the *new red* sandstone formation. But Mr Murchison was of a different opinion, and for some time they severally and stoutly supported these opposite views. At length, on a more extended survey, the Professor saw reason to strike his colours, and to admit that these rocks could belong to no other than the old red sandstones. These gentlemen were also satisfied that there was no perceptible line of demarcation between the coal-measures and the old red sandstones, inasmuch as they gradually passed into one another.

This allusion to the opinions of two such distinguished geologists, has been made for several reasons. In the first place, it is satisfactory to obtain such testimony to the correctness of the view which has been given in this memoir, of the character and epoch of these rocks. But, in the next place, an interesting proof is given, of the extreme difficulty which exists of pronouncing upon the character of red sandstones, and of saying whether they belong to the *new red* or to the *old red* formation. Now this difficulty is actually experienced in all its force, in other parts of the district of Berwickshire; because there is strong reason to believe that, on the south side of the Lammermuir range, patches of the newer formation actually exist, but possessing all the mineralogical characters and external semblances of the older rocks. Indeed, to such an extent has the author felt this difficulty, that he has not ventured to define on his map, by different shades of colour, the respective boundaries of the old red and the new red sandstone formations, but contented himself for the present with using the same colour for both, and marking with the letters *o. r.* those parts which seem to be decidedly the old red, and with the letters *n. r.* those parts which seem to be the new red. The red coloured parts which are not marked

with either of these signs, the author of this survey is yet unwilling to pronounce on, and leaves for further investigation.

Those parts of the red colour which are marked with a deeper shade, and present a spotted appearance, indicate the places where conglomerate is visible.

It would appear, that the old red sandstones have, like the greywacke rocks, since their deposition, been rent and broken across by some violent convulsions. The ravines of the Pease Burn and Heriot Burn, cut across both sets of rocks, and it will be seen by-and-by that the coal-measures exhibit similar dislocations.

Some of the rents and fissures are filled up with trap, as at Hardens near Langton, at Aikengalls above Dunglass, and at Carrolside near Earlston. These spots will afterwards be described when the igneous rocks are treated of.

There is an entire absence of any organic remains in the old red sandstones. The coal-measures, however, to which these red sandstones are only subordinate, are full of both land plants and marine animals, so that, although in some respects the coal-measures and old sandstones were deposited under similar circumstances, yet, in others, they must have essentially differed ;—conditions having prevailed during the deposition of the former, favourable to animal and vegetable life, which had not emerged at an earlier period. Into these inquiries, however, we do not now enter farther ;—but we see how important the fact is, that, whilst the coal-measures are most prolific of fossils, none at all occur in the red sandstones.

3. The next formation in the order of deposition is the *Coal-Measures*, which are indicated on the map by a black shade. These coal-measures, however, in so far as they are developed in this district, are not the rocks which form what is called “the coal-field proper.” They lie at an almost immeasurable distance below the Newcastle coal-field, and also below the great scar limestone of the north of England. In

fact, they constitute, as Professor Sedgwick has repeatedly declared, the lowermost beds of the great carboniferous series or mountain limestone group,—though the carboniferous matter exists in such abundance, that, in some parts, we have all the features of an ordinary coal-field. About four miles to the south of the Tweed, there is a thick zone of limestone, which is extensively worked, and indeed supplies all that is required for agricultural purposes in Northumberland and the Merse. From under the limestone, there crop out between it and the Tweed about twenty seams of coal, of which eight are worked, accompanied with all the appendages of steam-engines and railroads. Three of these seams extend into Berwickshire, and were formerly worked on the shore at Lamberton. The lowermost of these seams is five or six inches thick; the middle one about thirteen inches; and the uppermost between two and three feet thick.* Except at this single locality, no coal is found on the north side of the Tweed, all the seams cropping out several miles south of the Tweed;—and these are worked along a line which extends from the mouth of the Tweed to the east bank of the Till,—a distance of about fifteen miles. The lines of out-cropping are indicated on the accompanying map.

The only rocks of the coal-measures which crop out in Berwickshire, consist of shales, sandstones, limestones, and coal:—the first occupying the largest part of the district. They all rise, generally speaking, to the north-west, at an angle of about 20° or 30° , dipping from the larger chains of the trap and greywacke hills to which they are most contiguous.

It has been already stated that they rest on the old red sandstones; and, on the north side of the Lammermuirs, they are seen to pass gradually and almost insensibly into each other. On the south side of the Lammermuirs, however,

* Trials were lately made by Mr Geddes, mining-engineer, for a fourth seam, which the old fishermen on the coast talk of as six feet thick, and discernible only at very low tides. But he was unable to see any traces of it. He reported that the middle seam was of good burning quality, the third not so; and that neither of them were worth working.

there are unfortunately no means of making a similar observation. But that the coal-measures of Berwickshire do rest on the old red sandstone series is extremely probable; for, 1st, In no place are they seen to rest directly on the greywacke, or even to come near it, (except at Burnmouth, as will be afterwards explained); 2d, The red sandstones, with a conglomerate as their basis, appear resting almost everywhere on the greywacke, and occupying most of the intermediate space between the Lammermuirs and the coal shales; and, 3d, The coal-measures and the old red sandstone dip in the same direction, and are inclined at nearly equal angles to the Lammermuir chain.

It is true that the exact line of junction between the coal-measures and the old red sandstones, has nowhere been observed in Berwickshire; but this is a circumstance of little or no moment, when the evidence afforded by other facts is taken into account. These two formations, however, have, in many places, been traced *within a few hundred yards* of each other, without a single indication to weaken the force of that evidence. At Preston, for example, they are traced within a quarter of a mile of each other, dipping in the same direction, and at the same angle. In the channels of several burns near Marchmont, as well as in the banks of the Blackadder at Cessnock, they can also be traced very near to each other. At the latter place, there appear several thick beds of a fine-grained conglomerate, which is full of small particles of red matter, arising from the disintegration of an older rock, and is apparently the connecting link between the two formations.

Rents have taken place across the whole of this group of rocks, as well as in the older rocks previously described. The beautiful and highly picturesque glen at Dungleass, may be referred to as a proof of this, for its sides consist of immensely thick strata of coal sandstones, chiefly of a white colour, and full of vegetable fossils. The depth of this glen is, on an average for about a mile of its course from the sea, 150 feet.

In one part, the rocks appear to dip away on each side from the line of the burn. Although it is more easy to conceive the possibility of a burn wearing through sandstone than through greywacke rocks, yet the depth is so great, and the perpendicularity of the sides of the glen so precise, that a rent or fracture through the earth's crust seems infinitely more probable.

Another slip in the coal-measures of this district, may be seen in a quarry on the Whitadder, opposite to Broomhouse on the Whitadder. The rent runs north-east and south-west, and the strata dip from the line of fracture with an angle of about 20°.

Having thus described the outward position and characters of this series, we proceed to give some account of the principal rocks composing it.

1. The most abundant are the *shales*, meaning by that term the beds of soft clay which occupy the largest portion of the district. On the banks of the Tweed, the Whitadder, the Blackadder, the Leet, the Eden, and most of the minor tributaries of the Tweed, beautiful sections are displayed of these soft marl strata. They vary greatly in colour, being generally blue, often green, and occasionally lilac and yellow. They all, however, consist more or less of alumine, and occasionally they are impregnated with foreign substances, such as iron, magnesia, or lime, whereby their peculiar colours are determined. These variegated marls sometimes alternate in wonderful regularity, as, for example, on the south bank of the Tweed at West Ord and at Norham, and have the appearance, at a distance, of stripes of ribbon.

Some of these shales are harder than others, and of a black colour, from the quantity of carbonaceous matter they contain. These are the shales that usually accompany coal. Some of them are seen in the burns between Edrington and Foulden. The softer shales, which contain much calcareous matter, are occasionally worked for the purpose of being

spread over land as a substitute for lime, where the expense of the latter cannot be afforded ; but little or no benefit is ever derived from the experiment.

The contents of these shales, as indeed of all rocks generally, deserve particular attention ; for they often furnish no bad clew to the true epoch and formation to which the rocks containing them belong. In the blue shales *gypsum* occurs, both the red and the white varieties. It has been found at Burnmouth on the shore, at Hutton Hall on the banks of the Whitadder, at Milne-Graden where coal was bored for, on the Leet near Hirsell, and on the Tweed above Kelso. *Salt*, too, has been detected, not in the mineral form, but in springs which rise from the marl strata.

It is in these beds of blue shale or clay that the fragments of large *coniferae* were first discovered by Mr Witham of Lartington. The two localities from which he excavated the greatest number are, Tweed Mill, in the parish of Coldstream, and Allanbank, in the parish of Edrom. They occur in pieces not exceeding three or four feet in length, and two feet in diameter. The original form of the tree is seldom preserved. The fragment is generally flattened, and little of the woody fibre is left, nearly the whole being displaced by carbonate of lime, which forms a fine granular limestone. This limestone is so compact, that it is difficult to break it even with the hammer : but, when it is broken, pieces of carbonized matter, and of a honeycombed looking substance, are detected, being the external bark and woody parts of the original tree. No entire tree has yet been discovered. What are generally found seem to be pieces of trunks, rounded at the ends as if they had been transported, and worn down by attrition ; none of them are erect ;—they lie in the beds of clay parallel with the strata. Small branches have been occasionally found by the author, in immediate contact with these larger fragments, the shape and whole parts of which, though much impregnated with carbonate of lime, are completely preserved. One specimen in his possession is so fresh and entire, that the

resinous matter of the tree has, since he found it, oozed out from its interior.

Whence comes it that these fossil trees are converted into a granular compact limestone, when the strata in which they are imbedded consist merely of soft clay? The following answer is suggested. The mixed argillaceous and calcareous matter, of which these beds consist, as the internal parts decayed, insinuated itself by the weight of the superior strata, into the substance of the tree, and, combining with the carbonic acid of its vegetable parts, formed the compact limestone which now occupies the place, and often exhibits the very form, of the tree.

Beautiful sections have been made by Mr Nicol and Mr Sanderson of Edinburgh, of those Tweed Mill and Allanbank fossils, which exhibit, even to the naked eye, the reticulated structure and the annual growths of the tree. It has been remarked that the annual rings, as well as the whole internal structure of these trees, appear to indicate greater rapidity of growth, and more vigour in the powers of vegetation, than exist in the same species of tree in the present state of the world.

Allanbank and Tweed Mill are not the only places where these interesting fossils have been found. The author has noticed them on the south bank of the Tweed, a little way below Coldstream Bridge, as well as on the north bank of the river at Lennel Church.

In the dark coloured shales about half a mile below Coldstream Bridge, numerous impressions of a marine bivalve may be observed, which seems to be of the genus *Modiola*.

2. The rock which is next found more abundantly than those not yet described, is *sandstone*.

The sandstones of the district resemble exactly those which are found in the Mid Lothian or any other coal-field. The strata are sometimes fifty or sixty feet thick, and vary in colour from a dark red to yellow and pure white.

The red variety occurs immediately below the coal. It is

seen in large masses at Scremerston and Spittal, rising to the westward at an angle of about 30° , and crossing the mouth of the Tweed. Similar strata occur between Gainslaw and Edrington on the Whitadder, and on the Tweed at Paxton, Horncliff, Ladykirk, and Twizel. At all of these places, and others which might be mentioned in the same line, the dark red rock has been quarried in large quantities for building. But it does not afford good building materials, on account of its softness, which renders it extremely pervious to moisture and causes it to scale off. No organic remains have been noticed in this red sandstone.

After some little space below this red rock, (occupied with alternations of shale and thin bands of limestone,) sandstone rocks again appear, but not of a red colour. They are either yellowish or white, and are not so thick as the red kind. These sandstone rocks seem to occupy the intermediate parts of the Merse, between the banks of the Tweed and the line of the old red sandstone series. They afford much more durable, as well as ornamental building stone, than the dusky red rocks; and, accordingly, it is extensively quarried in different parts of the county on the Whitadder at Clariabad, Unthank, and Hutton Mill;—at Pitten Mill, Whitsome, Newton, Swinton, Hardacres, Eccles, Milne-Graden, Coldstream, and Wark, there are quarries which have produced abundance of this rock,—rivalling the stone of Craigleith and Cullelo in whiteness. Similar strata of white sandstone occur on the north side of the Lammermuir chain, as at Dunglass.

These yellow and white sandstones contain abundance of vegetable remains, exactly similar to those found in the sandstones of the Mid-Lothian coal-measures. The *calamites*, *filices*, *stigmarias*, and *equisetaceæ* can all be distinctly distinguished, and good specimens obtained in the quarries above enumerated, as well as in various other places where the sandstone is not worked, as at Preston, Gainslaw, Edrington, Leith, &c. So far as the author has as yet seen or heard, no animal remains have been found in these sandstones.

All of these varieties of sandstone occur in strata which attain a considerable thickness, and run for many miles continuously through the country. This may be particularly observed along the shore between Berwick and Burnmouth, as well as along the coast on the north side of the greywacke range.

But, connected with these sandstones, there is a class of rocks having a siliceous character, which seem to be only imbedded masses in the clay beds, and not to form continuous strata. Some of these sandstone rocks are so extremely coarse as to become conglomerates, consisting of fragments of rocks agglutinated together. One or two examples (of these large imbedded masses) may be given. Fig. 5, Plate IV. represents a section of rocks about three miles above Coldstream, on the north side of the Tweed. AA is the level of the river; at *a* there is a succession of thin shales and limestones, dipping E. N. E. at an angle of 10°. On them rests a thin stratum of yellow sandstone full of vegetable fossils, which dips into the river at rather a deeper angle, but soon rises again a little lower down, forming a trough or hollow, which now contains a large mass of black shale *c*. The vegetable impressions are most abundant at *e*, and entirely disappear at *f*, where the rock has been quarried.

The other example is taken from a spot on the south bank of the Tweed, a little below the confluence of the Till. In Fig. 6, *y* represents an irregular stratum of yellow sandstone, imbedded in a mass of blue clay *c c c*: *m m* are thin bands of yellow marl, and *s s* beds of dark coloured shale; *b* is a thin seam of dark carbonaceous matter. This stratum of sandstone contains vegetable impressions, and the greater part of it is a conglomerate, whose composition is so heterogeneous and complex, that it is difficult to describe it.

These wedge-shaped masses of conglomerate and sandstone are extremely common on the Tweed. They resemble banks of gravel or shingle, formed at the bottom of a lake or along the shore of a shallow sea, where are drifted together pebbles, fragments of vegetables, and other substances. Sometimes

the conglomerates are highly ferruginous. It was in one of these, situated near the chain bridge across the Tweed at Paxton, that Lord Greenock had the good fortune to discover an entire tooth, and the remains of others. An interesting account of this tooth was published in the *Edinburgh Philosophical Journal*. It was sent to London, and submitted to the inspection of Mr Clift. He could give no very confident opinion regarding it. But Dr Grant of Edinburgh afterwards more minutely examined it, particularly its internal parts, which had not been seen by Mr Clift; and Dr Grant announced that it was the tooth of the *Lophius Piscatorius* or sea-devil; (and, to use his own words), that it "had been preserved to us, precisely as it fell from the jaw, upon the loose sand."

But few shells or fossils of any other kind have been discovered in the sandstones of the district. In the sandstone conglomerate represented in fig. 6, some shells of a minute description have been found, which appear to belong to the genera *Teredo*, *Serpula*, and *Modiola*; but they are very indistinct, and no great reliance should be placed on them.

Under the beds of shale at Tweed Mill, wherein the fossil *coniferæ* were found, are several thin seams of sandstone, which contain quantities of vegetable impressions common to the coal-measures. They seem, from their structure, to have been reeds and other marshy plants.

3. The *limestones* which occur in this district are next to be described.

There are three kinds of limestone—the first consists of what is usually called encrinal limestone,—being the kind that usually accompanies coal. The second contains a great admixture of clay, and goes under the name of marl limestone;—the third, combined with magnesia, forms magnesian limestone.

The first kind of limestone is found in large quantities along the shore at Berwick, at Marshall Meadows, Lamber-ton Shiels, and Burnmouth. Some of the strata are five or

six feet thick. It is of light blue colour,—hard and compact. It is full of corallines.

The *marl* limestones are in thin bands, and never exceed 16 inches in thickness, and generally not more than 9 or 10 inches. These bands alternate with the beds of blue shale, and partake much of their argillaceous character. In colour they are a very light brown or dusky grey. They are easily affected by the weather, and break into small rounded concretions. The thicker beds have been occasionally burnt for limestone, but they contain so little calcareous matter, that the attempt to make use of them in this manner was soon given up. The last Earl of Marchmont, about fifty years ago, erected two lime-kilns, the one at Cessnock, the other nearer Polwarth; which were soon abandoned, however, the reason alleged being the distance from coal. The present Lord Polwarth, about thirty years ago, burnt a limestone which crops out on the west side of Smailholm, an experiment which is said to have been soon discontinued for a similar reason. But a better reason would have been the scantiness of carbonate of lime in the rock, in consequence of which it would neither pulverize, nor answer the purpose of a manure. Both at Marchmont and Smailholm, the alleged limestone beds consist almost entirely of argillaceous or siliceous matter;—at the former place it is a sort of conglomerate, the component parts being not chemically or even mechanically blended with each other, but so that they may be separately recognised. The particles do not exceed a barley corn in size.

There can be no doubt that the *Marchmont* limestone is one of the members of the coal-measures, for the reasons already given. Whether or not the *Smailholm* limestone is so, admits of great doubt, inasmuch as it is perfectly horizontal, and is a considerable distance from any well defined coal-measures. One thing these limestones have in common, viz. their immediate vicinity or contiguity to *trap*, the connection of which with these limestone rocks, however it is to be explained, cannot be doubted. This subject will afterwards be reverted to.

No organic remains have been noticed in these marly limestones.

The magnesian limestone is found in large masses on the banks of the Tweed, opposite to Birgham. It is a hard rock, varying in thickness from a few inches to three or four feet, and is full of red chert and jasper. On an analysis of this limestone it was found, that out of 100 parts 50 consisted of carbonate of lime, 44 of magnesia, 4 of silica, and 12 of peroxide of iron. Three or four thick beds at least of this magnesian limestone (rising to the west at \angle of about 15°), crop out between Carham Church and Haddon. At the latter place it was a few years ago worked in considerable quantities, for the use of the immediate neighbourhood. But the greater cheapness of the purer limestone, which is quarried between Berwick and the Till, has caused the workings to be given up.

A limestone occurs on the shore, about one mile north of Tweedmouth, of a yellow colour, full of drusy cavities, and containing large *producta*. From its colour, and appearance otherwise, there seems to be magnesia in it. Certain it is, that in the coal which crops out a few hundred yards above this limestone (it crosses the Tweed at the Carr rock near the river mouth) crystals of magnesian carbonate of lime occur in such quantities, as to diminish the purity and value of the coal, and cause it to be thrown aside as unfit for sale. The water which issues from this coal level (on the beach near Spittal), is so impregnated with magnesia, that it forms a pretty thick sediment in the channel of the stream.

These beds of magnesian limestone, are found at Wark, Lees, Coldstream, Lennel, and indeed every where in the marl strata on the Tweed banks. The beds do not generally exceed a few inches in thickness. They are cellular, and of a buff colour. The specimens obtained from most of the beds can hardly be distinguished from the magnesian limestone in the county of Durham, as for example, from specimens obtained under Teignmouth Castle. Mr Winch mentions that in the magnesian limestone at Lees, he observed bivalve shells.

They have not, however, been seen by the author of this memoir. Sometimes the thin beds of this yellow limestone are so disintegrated as to consist of mere sand.

No organic remains have been observed in the magnesian limestone.

4. The seams of coal are so few in the district, that they hardly deserve any notice. Those at Lamberton have already been mentioned, and they will again be referred to, in a more particular account of the rocks met with along the coast between Burnmouth and Berwick. They need not therefore be farther described, in this place.

On the north side of Lammermuir, three or four seams have been met with, and like the Lamberton coal were formerly worked. They appear on the shore near the mouth of Dunglass burn, and they also crop out in the glen of Dunglass. The remains of the old workings at the latter place are still visible. Beds of shale rise from under a stratum of reddish coloured sandstone, which is about sixty feet thick, and below those shale beds (of which the thickness may be forty feet), a seam of coal fifteen inches in width shews itself on the right bank of the stream. The other seams of coal are not easily found out; but they were worked at or near the spot, now alluded to. In proceeding up the rivulet half a mile, we pass a number of beds of shale and yellow coal sandstone; and then these are succeeded by enormous masses of dark red and coarsely granular sandstone, filled with veins and nodules of iron.

Coal has been bored for at various places in the county of Berwick, but without success. At Milne-Graden in 1827, a trial was made to the depth of 300 feet. It is said that the late Lord Haddington bored at Coldstream for coal about forty years ago, and that no coal was found. At Laws near Whitsome, Professor Low sunk to the depth of thirty feet, without discovering any symptoms of coal. At Pittenmill quarry near Dunse, the late Mr Hay bored to a considerable depth

with similar results. It is evident that no success could possibly attend these trials, as they were all made to the north of the line of outcrop of the known coal seams, and therefore far below them.

Three or four years since, Sir Francis Blake employed colliers to make trials on his estate on the south bank of the Tweed, four miles below Coldstream; and they bored several hundred feet at three places successively. Even here the borings were made too far north. Shales and sandstones were gone through, and it is said one seam of coal, but not sufficiently thick to be workable.

It may be added, as serving to shew still more completely the correspondence between the formations on each side of Lammermuir, that there are three seams of coal also at Blackshiels, on the north of Soutra. They were worked in 1796 to a small extent by Lord Lauderdale, (to whom the land at that time belonged). But there are none twenty inches thick. They are associated with numerous beds of dark blue shale, and these again rest on beds of old red sandstone, rising to the hills. The red sandstones are marked with the usual characteristic white patches, and at the bottom of all (next to the greywacke) is the red conglomerate.

The Blackshiels seams are probably the same which appear in Dunglass Burn.

5. Before concluding the account of the Berwickshire coal-measures, it will not be disadvantageous to give a more particular account of the rocks developed on the coast between Berwick and Burnmouth, at which last point the greywacke strata make their appearance. A formation can always be most satisfactorily studied along the sea-coast, where not only an extensive range can be viewed at once, but the manner in which [particular rocks pass into, and overlie or slip under others, can be narrowly inspected. This description, too, is of the more service, as it will be seen that it throws much light on the controversy, to what formation the

blue marls containing gypsum, which we have been describing, ought to be referred.

That the rocks at the mouth of the Tweed, on its north side, belong to the coal measures, is perfectly evident, not only from the fact of coal being worked at Berwick-hill colliery (which is within two miles from Berwick), and of the seam of coal there worked crossing the Tweed at Spittal, but also from the following enumeration of the rocks which crop out in the north side of Berwick Pier: those first mentioned being the lowest in the series.

	Thickness.
Blue limestone (rising W. \angle 20°),	3 feet.
Yellow limestone,	1
Soft stratum (nature unknown),	10
Yellow limestone,	2
Soft stratum of shales, &c.	35
Red soft sandstone with vegetable impressions,	120
Blue compact limestone,	2
Sandstone,	2½
Unknown,	13
Yellow coal sandstone,	15
Blue coal limestone,	1½
Unknown,	9
Blue coal limestone containing shells,	2½
Black shale,	3
Blue limestone with shells (rising W \angle 10°),	4
Unknown,	4½
Blue coal limestone with shells,	3½

In proceeding along the shore, we pass a series of shales, sandstones, and limestones, which form the cliffs for about one and a half miles, till we reach a projecting point of coarse red sandstone; and (with the exception of a small bay on the north side of this headland, in which nothing but soft grey-coloured shales appear), for about three miles to the north, the red sandstones form bold sea-cliffs about 100 or 120 feet high. At that part of the shore, which is opposite to a place on the road called Steps of Grace, the shales make their appearance, rising slowly to the north-west; and it is said that, at low-water, a thin seam of coal appears, which was formerly

worked by the fishermen and other poor people inhabiting the coast.

The shore continues, as far as Marshall Meadows, to present nothing but high cliffs of coarse red sandstone of the coal formation, very similar to the red sandstone on the banks of the Tweed, at Scremerston, Spittal, Paxton, and Ladykirk, as well as to the red sandstone which is quarried so extensively in East-Lothian, and from which Dunbar Church and Lochend House are built. The texture of the rock is soft; and, exposed to the billows of the German Ocean, it has in many places been hollowed out, so as to be indented by deep caves along the line of high-water mark, or to present shelving and overhanging precipices. About half a mile north of Marshall Meadows, the shales and limestones * again are met with, rising towards the north-west much as before. The cliff is about 120 feet high, and presents the following section from the top :

	Thickness.
Red sandstone of a coarse texture,	20 feet.
Slate clay or blue shale,	10
Do. but darker,	5
Coal limestone, with corallines clustered on the upper surface,	3
A seam of coal (3 inches),	1
Grey-coloured clay or shale,	20
Sandstone,	4
Slate clay,	6
Blue clay,	5
Slaty sandstone,	20

The ruins of the houses which were made use of many years ago for working the coal, are visible at this spot. The proprietor has lately attempted to get the workings resumed, by offering to let the coal, but without success.

At Lamberton Sheils (which is about one and a half miles north of the point last described), the coal-measures suddenly rise up towards the north-west at a very high angle; and on

* It is matter of surprise that these limestones are not worked. They are the ordinary limestone which is worked in the Lothians and Durham for sale.

more narrowly inspecting the locality, we find the trap projecting from Lamberton-hill, and throwing up the sandstones in such a manner, that, in one place where they are in *contact* with the trap, they are entirely vertical, and at another place near it they are partly *reversed*, and lean back towards the sea. A section of the cliff at the point where the stratified rocks suddenly begin to rise, shews the following rocks :

	Thickness.
Sandstone of a coarse grain, . . .	50 feet.
Coal shale of a dark colour, . . .	3
Sandstone of a white colour, . . .	12
Do. but a loose and friable texture, . . .	8
Black shale, . . .	3
A seam of coal, 12 or 13 inches, . . .	1

Fig. 7. represents the lower beds of red and white sandstones rising up out of the seas at Lamberton, and thrown partially into a reversed position by the trap T.

From this point to Burnmouth, the limestones, shales, and sandstones, run vertically along the shore, the trap being but a short way distant from it. The cliffs are (as shewn by the sympiesometer) on an average about 114 feet above high-water mark, and this consequently is the height of the vertical walls of shale and sandstones of which the cliffs, and the land for 200 or 300 yards from the shore to the base of Mordington-hill, are composed. At one spot, a vertical stratum of sandstone, about 70 feet high and 20 feet long, is standing between high-water and low-water mark, which at full tide resembles the remnant of some ancient ruin submerged in the ocean. Large blocks of sandstone lie strewed around it, as well as indeed along the whole shore, affording proof of the ravages of the sea on the adjoining cliffs.

The remaining interval of shore to Burnmouth, where the greywacke first occurs, is about half a mile; and the strata along it are so interesting, that it has been thought right to illustrate their relative positions by two figures.

Fig. 8. represents a section of the coast from a point of
(22)

land about 200 yards south of the village of Ross, to another point situated beyond the village of Burnmouth. The line of section is across the bay, in a west north-west direction, so as to make it as nearly as possible at right angles to the direction of the strata, and is about three-fourths of a mile in length. It is not to be supposed that a cliff actually runs along the whole of the line. It is coincident with the sea cliff only at *Burnmouth*, but the strata have been brought out to the rest of the line, merely for the sake of illustrating more distinctly their relative positions: *g* represents the greywacke, *s* sandstone rocks, *l* thick beds of limestone, and *m* beds of blue marl and clay, containing nodules of *red* and veins of *white* gypsum.

At the south end of the section, the vertical rocks which we had followed along the shore from Lamberton, are intended to be represented. It will be seen that, as they approach the greywacke, their dip gradually changes, till at length, at the point of junction, they are reversed, and slope back over towards the sea just as at Lamberton, delineated in fig. 7. There is no trap observable exactly at the point of junction, insinuating itself between the greywacke and the newer rocks; but, close to it, a red felspar porphyry is seen, forming part of a high hill which rises 100 feet above the top of the cliff. No red sandstone, or conglomerate belonging to that formation, is visible at the point of junction.

Fig. 9. is also intended to illustrate the relative position of the rocks just described. It is a section taken along the line of a burn which flows into the sea at the village of Ross (noticed in fig. 8.), and is in length about 400 yards. This section is very nearly at right angles to the direction of the strata, as they crop out along the north bank of the burn; *G* are (as before) the greywacke rocks; *s* the sandstone strata, *m* the beds of marl and clay containing gypsum (represented in the previous figure), *t* the trap, and *g* a portion of greywacke imbedded in the trap; *bV* is the line of the rivulet from the sea-beach *S* to the post-road.

One circumstance which seems remarkable in the formation at Burnmouth, is the total absence of the *red sandstone* group, which every where else distinctly underlies the coal. In what manner this is to be accounted for, it is difficult to say. Has the trap of Lamberton-hill, in rising up through the old red sandstone, entirely obliterated it? There does occur on the top of the hill, about half a mile from Burnmouth shore, a bed of conglomerate, which might be supposed to have been a part of the formation suggested as having thus been interfered with. But, on examination, it will be found that *this conglomerate* has not been lifted to its present situation by *trap*, and that, in fact, it has been deposited *since* Lamberton-hill was formed, and therefore, of course, since the deposition of the strata which have been overturned by that hill; for, 1st, it rests, not on trap, but on greywacke; and, 2^d, some of the imbedded fragments are rounded and water-worn masses of the Lamberton trap.

6. It is now proper, after having thus explained the nature and relative position of the beds of marl and clay which abound in the lower parts of Berwickshire, to advert shortly to the question which has been so often agitated, *Whether those marl beds do not belong to the new red sandstone formation?* It is well known that a part of this formation in other countries (the upper part generally), consists almost entirely of such variegated marls; and it rarely happens that gypsum is found in any other formation. The presence of salt, too, in the springs, lends some additional weight to the opinion; and it must be confessed, that, out of the three species of shells which have been found in the strata alternating with these marls, two of them, viz. the *Modiola* and the *Serpula*, are enumerated in the list given by De La Beche, of fossils found in the new red sandstone group. (*Manual*, p. 568-9.)

But none of the circumstances now referred to are pretended to be *unequivocal* proofs of a new red sandstone for-

mation. Sulphate of lime, we may easily conceive, must be formed in any bed of clay containing iron pyrites and calcareous matter. From what sources muriate of soda can be derived, we will not venture to say; but we may remark, that, in the coal-workings of Durham, it is not uncommon to meet with salt springs. The nature of the fossil shells, even if their character were clearly ascertained, is just as uncertain a criterion, on account of the partial knowledge we yet have of the fossil shells of the coal-measures.

On the other hand, these shells exactly resemble in character those of the strata which generally accompany the coal and limestone that is worked in Northumberland. They have all the same inclination (rising) to the Hills of Lammermuir; and, at Burnmouth, as we have just explained, where they contain a large quantity of both red and white gypsum, they are clearly and unequivocally seen to dip under the coal measures. No one who studies the relative position of the rocks in this part of the district, will continue to think it possible that they are not subordinate members of the Berwick *coal-field*.

Whether or not new red sandstone rocks cannot be detected in some other part of the district, is a different question, and to that we now proceed.

7. There will be found in the upper parts of Berwickshire, a series of red sandstones, which are not inclined to the hills, like the other strata we have been describing. In no place has a distinct line of junction between them and the inclined measures been discovered; but, in so far as can be gathered from observing them separately, the red rocks now adverted to, are disconform both to the coal-measures and to the old red sandstone. For example, at Cumledge, near Dunse, there is a beautiful display of dark blue shales and thin bands of limestone belonging to the coal-measures, which rise to the west at \angle of 50° . They form a cliff about 80 feet high, at a bend of the *Whitadder*. The edges of these shales, at their outcropping, are nearly horizontal, having been apparently

worn down by some erosive agent; and they are covered partly with alluvial debris, with some symptoms of thin beds of red sandstone. Within 300 yards of this spot, and south-west of it, is a quarry of red sandstone, where the rock is almost exactly horizontal; or, if not, perhaps dipping towards the east at an \angle of 2° or 3° . Unfortunately the respective strata cannot be traced to any spot exhibiting an exact line of junction; but they can be followed to the westward up the channel of a small burn which at this point joins the Whitadder; and in it the strata, consisting chiefly of yellow sandstone (with vegetable fossils in it), are seen rising to the west, at much the same angle as the marl strata. Those sandstone rocks can be traced up to a point opposite to, and north from, the above-mentioned quarry of horizontal red rocks, and distant from it about 90 yards. The relative situation of the places just described may be judged of from the sketch in fig. 11, where *W* is the river Whitadder, *m* the beds of shale and marl, *s* the strata of yellow sandstone, and *q* the quarry of horizontal rocks.

If the above be a correct view of the character of these rocks, fig. 10. will shew how they respectively lie; *q* representing the red rocks seen in the quarry, *s* the strata of yellow sandstone, and *m* the beds of marl and shale. A mass of trap, about 20 feet thick, is found among the sandstones, and is represented by the letter *t*. But the relative position of the rocks does not seem in any degree to depend on it.

About 200 yards to the west of the quarry just mentioned, the public road between Dunse and Preston crosses the burn noticed in the sketch (fig. 10.); and in the burn at this point, viz. at the bridge, there is a good section of the horizontal red rocks. *Rocks* they should hardly be called; for, though occasionally some portions are found hard enough to be used for building, they are, generally speaking, extremely soft, always slaty, and readily crumble to pieces.

Another proof that there are red rocks, more modern than

either the old red sandstone or the coal-measures, is, that wherever they come in contact with the greywacke, they are horizontal; as, for example, at Dodds Mill, near Spottiswood. Fig. 12. illustrates this locality, *s* representing the beds of horizontal red sandstone, and *c* a small-grained conglomerate beneath them; *g* are the greywacke rocks in contact with the others running about east and west, at \angle of 80° .

One circumstance which might assist in determining the age and character of these horizontal strata, is the nature of the fragments composing the conglomerates; for most frequently a conglomerate is found at the bottom of them. Now, though the fragments may obviously be derived from older rocks of any age, whether greywacke, old red sandstone, or coal-measures; yet, if any of the two latter be found imbedded in them, we shall have at once an unequivocal proof of the more recent origin of the conglomerate.

At Blackburne, a red conglomerate occurs, lying horizontally, and which, besides containing greywacke pebbles, has imbedded in it fragments of trap. Now (as will afterwards be shewn), most of the trap-hills in the neighbourhood were not thrown up till after the formation of the coal measures, and hence it seems probable that this is a new red conglomerate.

It has been observed, that these horizontal measures are much softer than the red rocks which dip under the coal-measures. In many places they consist of mere sand, and so fine as to be extensively used for mortar. It is seen at Billie, Lintlaw, and Heckspeth. At Polwarth mill, on the east side of Kyles hill, it forms a deep red clay. Its colour varies, however, from a vermilion-red to a buff or yellow colour.

These horizontal sandstones, though appearing, from their colour, to be impregnated with much the same quantity of iron as the older formation, never present the speckled appearance which the latter have, from the occurrence of white circles or rounded patches on their surface. Sometimes, indeed, after exposure to the air, specimens of these newer

rocks are found blanched, the red oxide having departed, and the metal gathered into strings and dendritic forms. Elegant specimens of these dendritic appearances are to be got in the quarry on the Blackhill, above the house of Cowdenknows. In these specimens the red colour has so entirely left the stone, that it is a pure white. Though, therefore, this change is owing to the same cause which gives rise to the white circles observable universally in the old red sandstone, the change in the former case does not take place in the rock whilst *in situ*, but merely in weathered fragments, and then the stone does not become speckled over with white circles, nor are the forms assumed by the deoxydized metal the same.

No other circumstances occur to be stated as indicative of the new red sandstone series, which have been noticed, at least in *Berwickshire*. Several other corroborating circumstances might be adverted to, which have been observed on an examination of these rocks in *Roxburghshire*; for they are very extensively developed in that county, and form a continuation of the Berwickshire series. These circumstances, as they are not observable within the district, cannot here be more than barely mentioned.

(1.) There are two kinds of horizontal red measures in the upper parts of *Roxburghshire*,—a white and a red variety. The white is exactly the same rock, in composition and texture, as the red;—but it is not impregnated with iron. Now, it is almost universally the case, that the white stone is found only in the upper part of the series. There is, for example, a quarry at the top of the hill, between Minto and Belshes, which consists of horizontal white strata, and affords beautiful building-stone. The sympiesometer shewed this quarry to be 723 feet above the sea. On the north side of Ruberslaw (a trap-hill between Hawick and Jedburgh), there are quarries of both red and white sandstone, which lie exactly like the strata in Belshes quarry, dipping from the hills at an \angle of about 2° or 3° , being thus very nearly horizontal;

and the white stone is there 681 feet above the sea, there being not less than 230 feet in thickness of red sandstone beneath, and about 100 feet of red and white sandstone intermixed, higher up the hill. Now, this is precisely the arrangement of the new red sandstone rocks in Germany, as described by De La Beche, the Weisliengendes forming the upper part, and the Rothliengendes the lower part of the series.*

(2.) On taking a wide and comprehensive survey of these horizontal strata, both in Berwickshire and Roxburghshire, it is found that *they occupy everywhere very much the same level* above the sea. The upper line of the red soil, in Roxburghshire, may be perceived on almost all the hills girding and surrounding them, so that the whole district may not unaptly be compared to an ocean of red waters studded with islands. Many points along the upper line of the horizontal sandstone, in so far as it is visible, have been traced by the author of this memoir, for the purpose of ascertaining their relative heights; and he finds, if the indications of the sympiesometer are to be trusted, that they agree most surprisingly. For example, the height of the upper line of these sandstones, on the north side of Ruberslaw, appears to be 981 feet above the sea; and the level is exactly the same on the south side of the hill. The upper line of red soil, on the south flank of the Eildons (about 15 miles north of Ruberslaw), was ascertained to be 980 feet above the sea, and this level is uniformly preserved round the hills to the eastward. Wolflee House (which is about 10 miles to the west of Jedburgh) is 681 feet above the sea, and apparently about 300 feet below the junction of the red soil with the hills, in the immediate neighbourhood. The upper line of red rocks in the quarry on Cowdenknows Hill (which seem to be the new red), is 1080 feet † above

* Manual, p. 359, (3d edition).

† This is assuming the hill to be 1200 feet high; of the correctness of which measurement, however, the author does not feel very certain, as it is taken from an old map of the county.

the sea, but there they have been elevated by the trap which composes that hill. Now, do not these facts indicate that there prevailed over this district of country some great sea or accumulation of waters, after the elevation of the coal-measures, the surface of which was *at least* 981 feet higher than our present sea? In no other way can we account for the deposition of these horizontal beds of sandstone, which in some places form a mass not less than 500 feet, and overlies the edges of the coal-measures. If such a sea existed, then, in every part of the country (submerged beneath it), where the old red sandstone rocks and the red sandstones of the coal-measures cropped out, there must necessarily have been deposited beds of sand and mud impregnated with iron, which the attrition of these red rocks by currents of water would abundantly furnish. For these reasons, therefore, we should *a priori* expect to find red rocks of a more modern origin, in or near those districts where the older red rocks prevailed; and if it be supposed that this sea we have spoken of, did not altogether overtop the Lammermuir Hills, but that its shore was along their southern flanks, we at once perceive that currents (always more frequent and violent near a shore) may have worn down the edges of the red rocks to such an extent, as to have supplied sufficient materials for the deposition of these horizontal sandstones.

Following out this train of reasoning, we must also admit, that these newer sandstones may not in every place have been precisely horizontal; for as inequalities exist in the bed of every sea, the sand and mud which was deposited on inclined surfaces would of course form strata, dipping slightly and generally from the hills. Nor can we expect that the upper line of these newer deposits should *everywhere* preserve exactly the same *horizontal* level, if a section were made of them from the country about Hawick and Jedburgh to the mouth of the Tweed;—for several circumstances may have contributed to give them a higher level in one part than in another. Much

would depend on the slope of the submarine bed on which they were thrown down ; much upon the depth or shallowness of the sea ; much upon the abundance of the materials required for the formation of these rocks. For example, in most of the bays which intersect a coast, it is probable that, though the silt and mud are forming strata which a section *across* the bay might shew to be horizontal, a section *towards* the sea would shew to have, on the whole, a gentle slope from the land.

(3.) Another circumstance deserving of attention, and which, in Roxburghshire particularly, seems to characterize these horizontal sandstones, is, that they are visible in the greatest abundance on the *east* of the isolated hills, which occur in the lower parts of the country, such as Ruberslaw, the Dunion, Peniel Heugh, Cowdenknows Hill, Bemerside Hill, Hume-castle, &c. From the east of these hills, long ridges run in an easterly direction, and little or no red strata are visible on their western sides.

(4.) It is also deserving of remembrance, that at Canonby, which is at the foot of the greywacke range that separates Dumfriesshire from Roxburghshire, the new red sandstone is seen very unequivocally overlying the coal-measures unconformably. The new red sandstone, as we learn from Professor Sedgwick and Mr Hutton, also traverses the county of Durham to a considerable extent, and hence it is the less surprising that the same formation should occur in Berwickshire.

But still it must not be imagined that the subject is entirely free from doubt. The above considerations shew that a wide and most interesting field of inquiry, connected with the existence or non-existence of the new red sandstone measures in Berwickshire, still remains to be investigated.

II. Having completed our account of the *aqueous* rocks, we now proceed to describe the *igneous*, or ancient volcanic rocks of the district. But these it is impossible to classify so conveniently as the former, on account of the infinite variety and

complexity of the substances composing them. The aqueous rocks are homogeneous in composition, formed of sediment, supplied in large quantities, chiefly from one source, and generally from the disintegration of rocks, whose nature we are well acquainted with. But rocks of a volcanic character bring with them, and contain, as component parts, substances of which otherwise we can know nothing, procured from Nature's own laboratory in the unfathomable depths of the earth.

One distinction of a general nature may be made, suggested by the different circumstances in which the trap has been ejected, and by the different effects (it may be added) produced by its outburst. We may describe, 1st, the Trap Hills of the district; and, 2d, the Trap Dikes. By the former, we mean the enormous masses of igneous matter, possessing no particular shape, and of which all the isolated hills of the district are constituted. By *dikes*, we mean those flows or currents of ancient lava which are occasionally seen traversing the strata of a country for many miles, running generally in straight lines, and preserving a regular and pretty uniform width. It will be found, that the stratified rocks which are contiguous or near to the trap *hills*, are always *dislocated, disturbed, or otherwise altered* by them. The *dikes* have affected the contiguous strata only by reason of their *high temperature*;—they seldom or never alter the dip or direction of the strata, but seem merely to have filled up rents and chasms previously existing in the earth's crust. The hills of trap attain an elevation above the surrounding country, of occasionally several hundred feet. The trap *dikes* seldom appear above the adjoining strata, but run usually in one uniform direction through the sedimentary rocks. The dike which crosses the Tweed below Coldstream runs sixteen miles, from the Kyle hills near Belford. One of the numerous dikes which have flowed from Home Castle in various directions, crosses the Blackadder at Cessnock below Greenlaw, a distance of five or six miles.

1st, Hills and amorphous masses of Trap.

These are indicated on the accompanying map by patches of green. They occur indiscriminately in all the formations.

The only attempt which can be made at farther arrangement, is by describing some of the principal and most obviously different traps which occur in the district. But this enumeration must necessarily be very imperfect, arising from our unacquaintance with the exact composition of many of the substances, of which these igneous rocks are made up.

(1.) The most abundant species of trap is the *felspar porphyry*, consisting of a basis of clay probably containing alumine and felspar, and filled with numerous particles of ill defined crystals of felspar. The colours of this rock are very various, as will be seen from the following catalogue.

Lamberton Hill consists of felspar porphyry. It is quarried in various parts, as shewn on the map by the Δ (deltas) marked on it; the rock taken out being used chiefly to metal the roads, for which its hardness well adapts it. On the south-west side of the hill near Sanson, the rock is of a grey colour; near Nunlands, it is dark green and purple. At Lamberton it is reddish-grey. At Burnmouth it is flesh-red, from the great abundance of red felspar which, amongst with the coarseness of its texture, gives it almost the appearance of a sienite. At Highlaws and Eyemouth Harbour, the same kind of trap may be seen. It is quarried behind Mr Renton's house, and is grey in colour. The trap which supports the conglomerate of Cromwell's Fort in the harbour, appears to be a portion of the same mass which forms Highlaws Hill.

At Hallidown, Coldingham Laws, and St Abb's Head, and along a portion of the Ale Water, are masses of reddish coloured felspar porphyry. The whole of these masses are very much the same in composition and external appearance, and are all probably connected with each other. Other considerations (to be afterwards submitted) render it probable that they all rose after the coal-measures had been elevated. Kyles Hill, near Greenlaw, consists of felspar porphyry, very compact. The basis is lilac or purple, and the imbedded crys-

tals of felspar are greyish-white. Cowdenknows, or Black Hill of Earlstoun, is at the top and north-east shoulder composed of a dark red felspar porphyry, not very dissimilar to the Kyles Hill porphyry, but it is not so compact. On the top of the hill there is the remnant of a vitrified fort, and specimens can be got from the old circles, one-half of which have been converted by heat into coarse glass or porcelain, the other half being still unaltered.

Bernerside Hill is another great mass of felspar porphyry, and extremely compact. It takes a conchoidal fracture; some of the fractures seen in the quarry, on the south side of it, are six or eight feet in diameter.

(2.) The kind of trap which is found next in abundance is *greenstone and basalt*. These rocks are classed together because they have much the same external appearance. There is indeed no essential difference between them in composition, except that the basalt generally contains more augite.

The following hills are composed of, and exhibit at their tops, this species of trap: Dunse Law, Hume-castle, Knock Hill, and Mellerstain Hill. But there are various other places, where it also occurs in irregular masses, as at Oldhamstocks, Borthwick near Dunse, Greenknows, Stitchell, Nenthorn, Smailholm, Blackcraigs, Brotherston, Dryburgh, and Merton.

It is unnecessary to enumerate or describe these localities separately, as the appearance and composition of the rocks are everywhere much the same. They consist of felspar, and hornblende or augite, in various proportions, with probably minute quantities of soda, magnesia, and lime; for these substances have generally been found in greenstone and basalt when analyzed. They also often contain beautiful crystals of green olivine and other minerals.

(3.) *Claystone porphyry* is the species of rock of which the **Dirringtons** are composed. The rock has a yellow or cream-coloured basis of clay, with small imbedded crystals of felspar. It is very compact.

The trap at Heckspeth may be considered a claystone porphyry, although very different from that of the Dirringtons. Its basis of clay is purple, and friable. It contains imbedded crystals of felspar, some of which are nearly as large as a pea. They occasionally resemble, from their green colour, the glassy felspar of the Drachenfels.

(4.) *Sienite* and *granite* may be seen in large masses, and indeed forming entire hills in several parts of Berwickshire: for example, Cockburn Law consists of an extremely compact trap, composed of felspar, quartz, and hornblende. At the top of the hill the felspar is green, forming sienitic greenstone. Lower down, especially on the south-east side, the felspar is red, and the rock has all the appearance of sienite. Stensheel-hill, which is south-east of Cockburnlaw, and half a mile distant from it, also consists of sienite.

At Fassney, and for about two miles to the north of Fassney bridge, the Edinburgh road passes over sienite rocks of a red colour. Granite appears also in several of the hills which join the Fassney water. The author of this memoir has some scales of mica taken from the granite there, about 4 inches in circumference. The sienite does not occur merely in irregular and amorphous masses. It occasionally occurs *stratified*, that is, in layers parallel to, and alternating with, the greywacke strata. It was respecting these strata of sienite that the Huttonians and Wernerians long contended so fiercely; the former maintaining that they were raised by the agency of heat from the interior of the earth,—the latter insisting that they were, like the rest of the strata in contact with them, of *aqueous* origin. The error of this last opinion has at last been admitted, even by those who once distinguished themselves as the champions of Werner's views, and who thus afforded, by their tardy yet honourable surrender, at once a strong testimony to the truth of the doctrine they had so long combated, and a gratifying proof of the purity and singleness of their own motives for engaging in the controversy. It is quite ma-

nifest, on examining the strata at Fassney, that the trap has burst up, through and between the greywacke strata, after the latter had been formed ; because, wherever the trap is in contact with these strata, they have been partially altered in composition by becoming more finely granular and greatly harder.

The following is a section of the rocks where several beds of sienite occur. They are all dipping about west at an angle of 80°.

	Thickness.
Sienite, reddish and very hard,	8 feet.
Ditto, but softer and yellower,	4
Ditto, very compact,	12
Greywacke, dark and fine granular,	2
Sienite, softer quality,	15
Greywacke, containing a vein of copper.	

The sienite is seen at various other places in the river, below the one just described.

On the north side of Soutra, in a rocky and precipitous glen, on the east side of the Edinburgh road, sienite trap occurs in thickstrata, alternating with vertical greywacke rocks, and running with them nearly east and west.

2d, *Trap dikes*, like the trap hills, may be classified according to the nature of the traps composing them.

(1.) A dike of *felspar porphyry* may be seen at *Burnmouth*, running into the sea nearly due east, and intersecting the strata of the coal formation. It may be traced for about 150 yards below high-water mark, and is about three feet wide. It is probably an overflow from the mass of igneous matter constituting *Lamberton-hill*, for it is the same species of trap.

(2.) Dikes of *greenstone* may be seen cutting through the south bank of the *Tweed*, opposite to *Lennel*, and at *Maxton*. The former is an overflow from the *Kyloe Hills*, situated between *Berwick* and *Belford*. It has been traced by the author for fifteen miles in a straight line, and it runs out or terminates in the *Tweed* at the point just mentioned. Its breadth at various places in its course is successively 32 feet, 27 feet, 24 feet ; the broadest part, generally speaking, being nearest the *Kyloe hills*. At the edge of the river opposite *Lennel*, it is only 3 feet wide, but at a point twenty yards distant from its

extremity, it is 8 feet. It runs in a S.E. and N.W. direction, and is exactly coincident with a line drawn from the Kyloe Hills to a point between Hume Castle and Stithell Craigs.

(3.) A sort of *claystone porphyry* best answers the description of dikes at Cumledge, Fangrist, Cockburn Mill, Carrolside, Hardens near Dunse, and Aikengalls near Dunglass.

The dike at Cumledge rises up between two masses of whitish sandstone of the coal formation, and appears to run N.E. and S.W. ; but its direction is not easily traced, from being visible only at one point. It consists of a dark purple coloured clay for a basis, and is full of beautiful green crystals of a mineral, which is apparently a variety of steatite.

The dikes at the other places are all found in the conglomerate of the (old ?) red sandstone formation. There are three which cross the Fangrist Water, one about two miles above Greenlaw, and 100 yards below the junction of that stream with the Blackadder ; and the other two about half a mile below this point. The one first mentioned runs in a S.S.W. direction, and is about six feet wide. Its basis is a dusky grey, and is full of small pea-shaped and pea-sized minerals, resembling globules of an earthy substance, foreign to the trap in which they are imbedded. Indeed, they look extremely like particles of red soil or sandstone which the trap had picked up in its passage. The other two dikes are close to each other ; they are only three or four feet wide, and run in a S.S.E. direction. They have much the same composition as the one higher up.

The dikes at the other places above mentioned, present in every one respect the same character, as those just described. At Aikengalls they are very numerous. The conglomerate strata in which they are seen there, form great hills, through which the streamlets have cut deep ravines, and exposed the dikes well to view. One of those dikes presents a most fantastic appearance : it is only about eighteen inches thick, and it crosses one of the streamlets at its confluence with another, and stands in a point of ground between the two. From one

(the lower) side of the dike, the conglomerate has been entirely removed, by the united action of the stream and weather ; and it runs up a precipitous bank for nearly thirty feet, reaching a height of between seven and fifteen feet above the level of the soil. Portions of the conglomerate are still adhering to the opposite side of the dike, and when viewed from a distance, the whole has exactly the appearance of the wall of an ancient fortress : fig. 18. is meant to give some idea of the spot. It goes amongst the country people by the name of the Fairys Castle. The direction of the dike is S.S.W. and N.N.E.

At Hardens the conglomerate dike is only 18 inches thick.

Near Carrolside there are two dikes visible, one on the new road, the other in the Leader Water ; the former is only eighteen inches thick, and runs in a direction E. by S. and W. by N. It is probably the upper part of the same dike visible at the water's edge, which is about 200 feet below the line of road.

The last spot, however, deserves some further description, on account of the junction it presents of the conglomerate and the greywacke strata,—as well as on account of the dike, which runs through both. Fig. 13. represents this spot : G is meant for the greywacke strata, which rise to the height of six or seven feet above the level of the river W ; their edges are covered by the conglomerate C, and through both of them the dike *d d*, cuts in a vertical direction, and may be seen rising up through the bank for about eighty feet, when it becomes hidden by rubbish and brushwood. The thickness of the dike is eighteen inches at the bottom, but only about twelve inches towards the top. It varies in width in different parts, owing probably to the obstructions it met with in its course upwards. It is full of minute red crystals, apparently peroxide of iron. The direction of this dike is evidently owing to the dip and run of the greywacke strata through which it rose. A dike of much the same description as the above, occurs about half a mile below Cowdenknows House, on the east bank of the river.

The dike at Cockburn Mill also merits a figure to explain it. In fig. 14, *t* represents a bed of horizontal trap, which has flowed up through strata of old red sandstone. The particular strata over which it has spread *c c c*, are red and white clays. There is nothing on the top of the trap but alluvial debris. *R* is the level of the river Whitadder, on the east bank of which the foregoing section is seen. The length of this section of trap is sixty yards, its depth about one yard.

(4.) By *Amygdaloidal Tuff*, a coarse conglomerate-looking rock is signified, having a clay basis, with a number of imbedded minerals, round in shape, and sometimes as large as almonds; they strongly suggest the idea of a current of liquid lava, which, in flowing from its crater, has picked up various matters in its way, whether earthy or mineral, and by its excessive temperature altered and modified their composition; such traps may be seen at Cessnock on the Blackadder, Preston on the Whitadder, and Birgham on the Tweed. There is also a species of amygdaloidal trap, though very different from the kind just described, in Polwarth Burn, in Langton Burn above Langton House, and in Billie Burn;—but this last kind seems to be much contaminated with the red soil it has flowed through.

Having now endeavoured to describe the chief varieties of trap in the district, we must advert shortly to their effect on, and their connection with, the other rocks contiguous to them.

(1.) The first circumstance which strikes the geologist is, on the one hand, the dislocation produced on contiguous and adjoining rocks by the trap *hills*, and other large masses of igneous matter; and, on the other hand, the non-disturbance of such strata by *dikes*. At Burnmouth, Cessnock, the Fangrist, Aikengalls, Carrolside, and Lennel, where dikes such as we have been describing traverse stratified rocks, there is no derangement of the latter, no effect whatever, except an occasional hardening by the heat of the igneous current. But no example can be found of a trap *hill* which has risen through stratified rocks, without upturning and dislocating them to a greater or less extent. For example, we see that the coal-

measures have been hove up and thrown into even a reversed position, by the trap of Lamberton-hill; the (new) red sandstones have been raised out of their horizontal condition by the traps of Cowdenknows, of Bemerside, and of Hume Castle.

(2.) One effect, however, common both to trap hills and to trap dikes, is the change which they produce on contiguous rocks by their high temperature. It has been already noticed, that trap has the effect of hardening the softer rocks in contact with it.* It seems also to have another effect, that of causing the various substances which may be blended, chemically or otherwise, in a single rock, to separate and form distinct particles or veins of these different substances. It is observed, for example, that the greywacke strata among the Lammermuir Hills, most fruitful in metals (particularly copper), are those which are contiguous to trap;—as at Fassneyburn, Elmford, and Ordweel, where the sienite rocks are so extensively developed. The strata among the newer rocks, which contain the most *lime*, are in contact with, or close upon trap. But it is not lime alone that is developed, for every other substance generally diffused through the rock is caused to separate and run together. Thus, the magnesian limestone at Birgham, which is full of red chert or jasper, is close to trap; and rocks of a similar description, viz. full of chert, and containing visible particles of lime, are found at Hardens, and Cumledge, in contact with trap. In like manner, the rocks at Smailholm and Marchmont, which were formerly burnt for lime, are in contact with trap. These circumstances seem to bear some analogy to the well-known, but not yet fully understood effects of trap on the dolomites of the Alps.

(3.) There is something peculiar in the *forms* which the trap hills assume. Many of them present rounded knolls, as Kyles Hill, Lamberton-hill, and Bemerside Hill, which are softer kinds of claystone porphyry, and have been probably a good deal altered in their original forms by the weather.

* The Kyløe dyke already noticed, which crosses the Tweed below Lenel, has converted the coal seams intersected by it into a sort of cinder,—the bituminous matter having been entirely dissipated.

Those trap hills, however, which do not suffer much in this way, present a very different outline. They are rugged in their appearance, consisting generally of several plateaux, the one rising above the other, the uppermost of all being generally the most crystalline, and of course the hardest. Such is the arrangement visible at St Abb's Head, at Hume Castle, on the Knockhill, and at Black Craigs. This phenomenon (if such it may be called) may be accounted for by the successive outbursts which took place from time to time, as the igneous matter accumulated, and the eruptive agent gathered fresh power, so as to produce another outburst,—and also by the fact that the *central* parts would take the longest time to cool, and thus be more perfectly crystallized.

Some curious distortions and fantastic appearances have been produced by the unequal cooling of different kinds of trap. Fig. 15. represents a pillar of trap, on the shore near St Abb's Head. It is about 40 feet high, 15 round at its base, and about 50 feet round in its upper parts. The peculiar form of the mass may probably be accounted for, when it is mentioned, that the upper half is a different species of trap from the lower half, so that these two masses must have cooled unequally. The upper trap is a composite rock, a sort of clay-stone porphyry with much admixture of calcareous spar, whilst the lower trap is a more simple rock, and much more compact.

III. Having thus described the aqueous and igneous, or sedimentary and volcanic rocks of Berwickshire, it is proper that, in a survey of this kind, we should next advert to certain more modern deposits, which cannot be comprehended under either of these classes. They are more extensive than might be imagined by a casual observer, who looks only at the surface;—though even a cursory examination of the district must shew, that its outline and soils have been greatly affected by them. To the eye of the geologist, these comparatively recent formations are especially interesting, as being strongly significant of the revolutions which have taken place on this part of our globe.

1st, The first deposit which may be noticed is a *conglomerate*, which in some places is not unlike a very hard gravel bed, such as is commonly met with among diluvial debris; but which, from its solidity, thickness, extent, and uniformity, seems to be of older date, and referable to a different origin.

These conglomerates are seen in several parts of the district, though chiefly near the sea coast. A conglomerate of the kind we allude to, is on the top of the sea cliff, south of the Pease Burn, extending for about a mile along the shore. It is on an average about ten feet thick, and when viewed from the sea, it appears perfectly horizontal. It is possible, however, that it may dip gently to sea-ward. Its height above high water-mark, measured by the sympiesometer, is about 150 feet. Among the rounded fragments comprising this conglomerate, are greywacke, greenstone, soft red sandstone, and limestone of the coal formation, containing organic remains. Now, the rocks composing the cliffs at this point, and on the edges of which this conglomerate is resting, are chiefly red sandstone, which rise to the land at an angle of about 60°. When the tide is out, the edges of the sandstone strata may be seen rising towards the shore, and strata of limestone may be discerned among them, by their jagged edges near the line of low water-mark. It is extremely probable, that those sandstone and limestone strata have supplied materials for this mass of conglomerate. The manner in which the fragments of rock are lying in the bed, indicates a tranquil deposition, for those which are of an oblong shape are lying horizontally in the mass, and in some parts a thin stratum of red sandstone runs through the conglomerate also horizontally. The rock is nearly as compact as the old red sandstone conglomerate, and the interstices between the imbedded fragments of rock are filled with calcareous spar.*

* It is proper to observe, that the description which has just been given of the composition of this conglomerate, applies only to the part of it next to the Pease Burn—the rest of the bed to the south not having been yet examined.

No traces of this conglomerate are apparent on the north side of the Pease Burn. How far it extends inland the author has not yet ascertained. At its southern extremity, it abuts against and is terminated by a hill of greywacke, which there rises about sixty feet above the general line of the cliff.

At Eyemouth, there is a large accumulation of conglomerate which forms the point of land, on the north side of the harbour, called Cromwell's Fort. Fig. 16. is intended to represent this conglomerate, having numerous beds of red sandstone or clay interspersed through it. It is resting on the felspar porphyry T, formerly described. On an examination of the line of junction, it will be found that the conglomerate must have been deposited on the trap *after* it had been ejected, for the former is in no respect hardened where in contact, nor are there any appearances of veins shooting into the conglomerate from the trap, as would have been the case, had the latter risen up after the deposition of the conglomerate. The beds of conglomerate and of sandstone or clay included in it, appear to be now exactly in the same state as when they were when originally formed, no derangement or disturbance having subsequently taken place. The highest point of the conglomerate at Eyemouth, is about eighty feet above high water-mark. The fragments consist chiefly of greywacke ; but there are also pieces of trap (felspar porphyry). This conglomerate is well consolidated, but numerous cracks and fissures traverse it in every direction. The consequence is, that the rain easily penetrates the whole mass, and in winter immense blocks are loosened from the cliff, and fall on the beach. Probably Eyemouth harbour is now twice the size it once was, in consequence of the rapid rate at which the conglomerate has been worn down and carried away by the tides. The rock is used for building ; and that it is well adapted to resist the weather, is proved by the fact of the sea-wall of Eyemouth harbour having been constructed with it fifty years ago, and that it has never needed repair.

The next part of the coast, where conglomerate shews it-

self, is at Burnmouth, a few hundred yards to the north of the Revenue Station. There are several patches of it, two in the channel of the burn, and another about a hundred yards north of the burn. They are all within a few feet of the same level above high water-mark, viz. 63 feet. The two former masses are composed entirely of the felspar porphyry of Lamberton-hill, and being of a flesh-red colour, the materials were probably derived from that part of the hill, not more than 300 yards off, where alone this variety of trap is observable *in situ*. The other mass of conglomerate 100 yards to the north, consists entirely of greywacke fragments, which have been supplied, most probably, by the superincumbent and contiguous cliffs.

At Lamberton, close to the spot formerly described (where the trap heaves up the coal-measures), two patches of conglomerate are seen; the one on the north side of a small bay, the other in the middle of the bay about 300 yards from the former. They are both at the same altitude above high water-mark, viz. about 116 feet, taking a point as nearly as possible in the middle of the mass (which is about 40 feet thick). These masses stand out from the cliffs, having resisted the action of the weather. The fragments in them are exclusively Lamberton trap, some of which are nearly as large as a man's head, and not very much rounded. Occasionally there are indications of horizontal layers or strata of a reddish sandstone in this conglomerate.

So much for the beds of conglomerate observed along the coast.

It is not to be expected that such beds could be easily detected in the interior of the country, even though they really existed there. But some spots the author has noticed. One has been already mentioned: it is near the top of a hill about one mile west south-west from Burnmouth, above Flemington New Inn. It is forty feet thick, and can be traced for about 400 yards along the brow of the hill facing the sea. The top of the conglomerate, according to the indications of the sym-

piesometer, is 459 feet above high-water mark. The imbedded fragments are greywacke and Lamberton trap; it is horizontal; one or two seams of red sandstone are perceivable in it, which dip gently towards the sea. The whole mass is very compact.

About half a mile above Milne-Graden House, a conglomerate bed shews itself on the north bank of the Tweed in three places, standing out from the alluvial soil. It resembles in every respect, except thickness and extent, the conglomerate of the Pease Burn. It cannot be traced further than 200 yards, and its thickness does not seem to be more than four or five feet. It is more compact than any *diluvial* deposit; but it yields more readily to the hammer than the conglomerates previously described. It is about 56 feet above the level of the sea, being 48 feet above the ordinary surface of the river. This conglomerate consists chiefly of greywacke pebbles, felspar porphyry, having a purple coloured basis (very hard), red limestone, and yellowish sandstone.

2d, We now proceed to give a sketch,—and our space requires it to be but a brief one,—of deposits which are apparently still more recent than what have now been described. These may be included under the general name of *Diluvial Debris*.

Over almost every part of the surface of Berwickshire, and particularly in the eastern parts of the county, extensive and deep accumulations of loose sand and gravel are found, consisting of water-worn fragments of rocks of every age and description. These gravel and sandy deposits are very generally in the form of high ridges running in an east and west direction. Good examples of such may be seen at Hardacres in the parish of Eccles, and at Kaimknow between Newton-Don and Kelso. Sometimes they form well rounded knolls, as between Lamberton Shiels and Marshall Meadows. It is also an observation which admits of frequent verification, that these accumulations of gravel are more frequent on the east side of the rocky hills in the district than on the western side.

The depth and superficial extent of these accumulations of sand and gravel are very great in different parts of the country. On the estate of Milne-Graden, for example, in Coldstream parish, there is a bank of gravel and sand which runs for about a mile in an east and west direction, and is about half a mile in breadth. The sand lies over the gravel, and is between fifty and sixty feet thick.

The fragments of rock which are found imbedded in these accumulations of sand and gravel, vary in size from small gravel to large blocks many tons in weight; those which are the largest are also the hardest in texture, and yet they are all more or less worn down to a globular shape. Large blocks of *mica-slate* (a rock which does not occur in the south of Scotland at all, unless perhaps in Galloway), have been found near Dunse Castle, at Blannerne East Side, and at Coldstream. Blocks of *granitic greenstone*, gathered out of the soil, may be seen at Billie (where they are used for gate-posts), as well as at Blackburn, a farm about four miles to the south-east of Billie.* Cockburn-law, which is the nearest point from which such blocks could come, is west north-west from Billie about eight miles. The characteristic *yellow trap* of the Dirringtons is found in Langton-burn, above Langton-house, which is east south-east from them about five miles. The *Kyles-hill* trap has been observed at Pittenmill Quarry, which is east south-east from Kyles-hill, and is distant about six miles. The felspar porphyry of Cowdenknows-hill is strewn all over the plains which slope down from it to the eastward. Blocks of *greenstone* (as is well known from history), about two centuries ago, covered the whole country on the east side of Dunse-law, and towards Preston; though these witnesses of the heroic deeds or bloody strifes of our ancestors† have long since been carted away from their ancient sites, having furnished the

* All the bearings in this Essay are by compass.

† In the Border History there is an account given of a rencontre between one of the Homes of Wedderburn, and a Frenchman of some celebrity, who was slain by him near this spot. The Frenchman had fled; but the historian relates, that his horse was impeded and obstructed by numerous blocks of stone, which lay scattered over this part of the country.

peaceful farmer with materials for his walls and offices. Similar blocks are spread over the country at Gordon, and they can also be seen sticking out of the moors to the north and north-west of Greenlaw. In the channel of the Blackadder, about half a mile below Cessnock, there is a block several tons in weight; and one was dug out of the soil at Marchmont, some years ago, equally heavy. At Blackburn, blocks of a *cherty sandstone* are found in the rivulet, none of which rock occurs in the district *in situ*, except at Cumledge, which is about seven miles distant, and west south-west from Blackburn; and at Hardens, which is four miles further off in the same direction. On the banks of the Blackadder, above Fogo, may be observed for several miles great banks and beds of red clay and gravel, which cover the edges of the blue marl strata.

These facts afford irrefragable evidence of the nature of the agent by which these alluvial debris have been formed;—that agent could be no other than a great accumulation of waters, which moved chiefly from the westward.

But that this was not the only current, is evident from other facts. The sand deposit, formerly referred to as in the parish of Coldstream, contains some fragments of coal larger than a man's hand, a good deal water-worn. Pieces of coal are likewise found in the alluvial soil of the Tweed, about a mile above Milne-Graden House. The coal nearest to this spot is six miles to the south; the next nearest localities are at Berwick, the Carter, and East-Lothian. The probability is, therefore, that these pieces of coal were transported from *the south*. About two miles north of Spottiswood is a hill, the north base of which is girded by a stream called the Brunta-burn. The *northern* face of the hill is entirely free from soil, whilst the south flank of the hill opposite to it, on the other side of the burn, is covered with boulders and deep alluvial debris. In a small valley close to St Abb's Head, pieces of red sandstone occur in the debris, which have probably been swept from the *northward*, where they occur about five miles off.

These facts seem to warrant the inference, that whilst the

general movement of the diluvial waters was from the westward, there were many minor or accidental currents which had different directions.

3d, There is another, and apparently a still more recent deposit which cannot be overlooked entirely, viz. *Shell-Marl* and *Peat-Moss*; the former has been found at Kimmergham, at Whitburn, at White-rigg in Merton parish, and several other places of less note. At Whiterigg, it is said that it was found, on analysis, to contain 73 per cent. of lime;* but the effect produced on the soils, when the marl is spread on them, is not commensurate with so large a proportion of lime.

The strata are generally white or grey, and are perfectly horizontal. They are full of very minute shells, chiefly the *Planorbis* and *Lymnea*. At Kimmergham (where the moss contains seven acres), the beds occur in the following order: at the top there is a covering of peat, which in some parts is ten feet deep. Below this there are two beds of white calcareous marl, each six feet thick, filled with the shells above specified,—these beds being separated by a stratum of blue clay.

Remains of the beaver, and horns of a large species of deer (animals both now extinct in Scotland), have been found in the shell-marl of Kimmergham. Similar horns occur in the peat-mosses near Whitburn, and in the shell-marl of Whiterigg. The shell-marl at this last place extends to 100 acres.

That these beds of shell-marl were deposited in lakes which have now disappeared is undoubted. In the History of Dryburgh Abbey, the “*Lake of Merton*” is often spoken of; and it appears it had been granted to and possessed by the monks of that monastery, on account of its excellent fish.

In the peat-mosses,—as, for example, at Whiterigg, Whitburn, and Dogden,—quantities of trees are found, chiefly the birch; and hazel-nuts too have been occasionally discovered. In most cases the bark of the trees is preserved, though the interior parts have decayed.

* This is taken from the account of Merton parish, recently published in the Statistical Account of Scotland. The analysis was by the late Dr Kennedy of Edinburgh.

4th, In a survey such as the present, it is perhaps unnecessary to say much either of *alluvial deposits*, or of the action of *running streams*. All that is worthy of being noticed of a purely local nature, on the first of these matters, is that, when the Tweed is much flooded, its waters, yellow with the sediment they are loaded with, have been observed at a distance of three miles from its mouth,—the line of demarcation between the fresh and salt water being distinctly visible. The delta of the Tweed, therefore, must extend at least five miles from its mouth.

This subject it would have been unnecessary to have prosecuted further, but for the purpose of noticing a curious ridge of sand and gravel, called the *Kaims*, which runs through the upper part of Berwickshire,—and of suggesting another to the many theories that have been proposed to account for them.

Plate V. is a ground-plan of the Kaims. They consist, it will be seen, of two parts; the easter ridge being divided from the wester by the river Fangrist, which runs to the south. The general height of the easter half, *above* the bog (called Dogden Moss) by which it is surrounded, is about fifty feet; (some of the heights are marked on the plan). The western ridge is not so high; the bog or low marshy ground, out of which the eastern ridge *rises*, not *extending* so far to the westward. But though the west ridge does not stand so high above the muir surrounding it, as the east ridge does above Dogden Moss, the absolute level of both ridges above the sea is pretty nearly the same; and further, the level of the east ridge *corresponds with* that of the neighbouring muir *adjoining* the moss.

The adjoining muir begins to rise from the moss at 400 or 500 yards distance from the eastern Kaims on their south side, and the face of the acclivity runs in the direction indicated by the line *a b*. A cart-road runs along the base of the acclivity, where it is a few feet above the level of the bog.

It will thus be perceived that the general line of the eastern

ridge is parallel to the line of adjoining *high* ground, and consequently, to the course of the streams occupying the low ground. The same observation applies to the direction of the western ridge.

The ridge is composed of sand and gravel, and runs, if its sinuosities are taken into account, for a distance of two and a half miles. There is more sand at the eastern extremity than at other parts, and there the ridge is the lowest. The highest parts consist of the coarsest gravel.

The gravel consists almost entirely of greywacke. No trap is observable in them,—a circumstance which is the more important, as Kyles Hill is only about one mile to the south, and the Dirringtons one mile and a half to the north. Some few pieces of red sandstone are observable in the gravel.

No one can have a doubt, who sees the manner in which this annual accumulation of sand and gravel has been formed, that it is an *aqueous* natural deposit. Several circumstances tend to prove that the beds of sand and gravel composing the ridges are connected with the diluvial detritus, which abound so generally over the whole country: and the fact of there being no Kyles Hill or Dirrington trap in the gravel, favours the idea of its having been deposited by the same waters to which those diluvial debris owe their origin, and which, as we have seen, came probably from the west. Further, that these debris have been deposited on the very spot where the Kaims run, is demonstrated in the banks of the Fangrist and its tributaries, which have cut deeply through these debris.

It has been mentioned, that, generally speaking, the upper line of the whole ridges is on nearly the same level as the adjoining muir, which muir consists of a deep layer of diluvial gravel. Now, it would rather appear, that the space between the adjoining muir and the south flank of the Kaims has not always been so low as it now is; but that, on the contrary, a great deal of gravel and sand have been washed out of it, by a number of streams which still flow there. Suppose that

originally there was no bog at all between the eastern ridge and the high ground *a b*, or that at most there was only a gentle hollow, and that the substrata consisted of accumulations of sand and gravel, such as the Kaims consist of,—streams would be formed in that hollow. They would soon make deep indentations in it, and in process of time, remove a large proportion of the debris; nor is it difficult to see how, in this way, the level of the intervening space, though originally as high or nearly as high as the Kaims, might be worn down and hollowed out into the bog which now exists.

If a similar operation were simultaneously going on a little further to the north, the same results would of course follow, and thus the ground would be so worn down and lowered by two streams running parallel to each other, as to form a ridge between them.

Are there any circumstances which indicate that the Kaims were actually formed in this manner? *1st*, We see that there *are* streams on each side of the Eastern Kaims, and formerly there may have been more, before the surface had been much worn down. The stream on the south side, is not nearly so large as the Fangrist which runs on the north, and accordingly the ground on the south side is not so low as on the north. *2d*, The western ridge does not stand so high above the muir as the eastern branch, for there are no streams very close to it; but when, in process of time, the rills and rains have worn down the contiguous soil to a level with the moss, the western division will acquire exactly the same prominent appearance as the eastern one.

It has been thought right to give this detailed account of these remarkable ridges, on account of the singular appearance which they present in this part of the country,—on account, too, of the number of theories which have been invented to explain their origin. The credit of having formed them has by some been bestowed on the warlike inhabitants of olden times, who it is said erected these stupendous bul-

warks for purposes of defence. By others they have been accounted for on the supposition of a violent rush of waters from the north, which, by the accumulation of the accompanying debris, formed a dam or weir at that particular spot, across their own course !* The author does not mean to undervalue the merit of other observers who have suggested these explanations. He admits that much difficulty attends the solution of the whole problem ; and he offers his own explanation merely for the purpose of stimulating and directing further investigation.

We must take care, however, not to attribute too much to the effect of running streams. The high banks and deep ravines through which the rivers of the district run, may, where the strata are extremely soft, to a certain extent have been deepened by them. But there is strong reason to think that many of the ravines and valleys which now guide our rivers in their course, have been primitive and aboriginal hollows in the earth's surface, produced by different causes. We have already pointed out several rents and chasms intersecting the greywacke, and old red sandstone groups, as well as the coal-measures, which undoubtedly took place at a very early period.

Valleys, too, may be formed by the accumulation of sedimentary matter in long ridges, and this may easily have happened at the bottom of such a sea as that which must have existed when the new red sandstones were deposited. The position and direction of these red sandstones, as we have already observed, seem to indicate a current to the eastward ; and if such existed, then not only the new deposits would be formed in such a way as to form valleys tending in a particular direction, but the bed itself of the sea might be worn down into submarine valleys having similar directions.

There is still a third mode in which valleys may have been formed, independently of the agency of rivers. In a volcanic district the igneous matter does not spread out or accumulate

* New Statistical Account of Scotland.

in a united and horizontal mass. Separate hills are formed, whether by reason of outbursts from different *foci* of eruption, or by reason of refrigeration and crystallization on a large scale, which causes trap to separate into isolated masses.

Several valleys in the trap districts of Berwickshire undoubtedly existed before they became receptacles for the waters which now flow in them. None will assert that the Whitadder could have cut through the adamantine rocks of sienite which compose the sides of the ravine between Cockburnlaw and Stenshiel. The tops of these hills are probably not more than a mile distant from each other; and the channel of the Whitadder is between 600 and 700 feet below the one, and about 300 feet below the other. The valley at St Abb's Head, which separates the trap-rocks from the greywacke, is also beyond doubt aboriginal; and the more clearly so, on account of there being no river or rivulet which runs or could ever have run in it. The masses of trap which have been ejected there, at first most probably filled up that valley, as well as the one above mentioned; but by cooling, they contracted in volume, and shrunk as it were towards their central *nuclei*, and thus formed valleys, hollows, or deep ravines.

There is great reason to think that the Tweed now runs along a line of fracture of the earth's crust, similar to those which so obviously exist at Dunglass, Colbrandspath, Pease Burn, and Eyemouth. In the first place, the direction of the Tweed is nearly the same with that of these rents, and all are parallel with the greywacke chain which crosses the south of Scotland from sea to sea, as well as with the trap of the Cheviot range; 2d, Several slips and sinkings of the strata actually occur in the course of the Tweed, as, for example, at Upsetlington, Sunnyside, and Berwick; 3d, When allowance is made for the windings which the river has partially effected by wearing down the strata here and there, it forms, for a great part of its course, nearly a straight line; 4th, About a mile above Milne-Graden House, there is (as already mentioned), a bank of gravel between forty and fifty feet higher than the present level of the river, which contains pieces of coal, fragments of

limestone, red sandstone, and greywacke. This bed of gravel could only have been deposited at the bottom of a sea, which covered the district. But it is between forty and fifty feet below the top of the river's banks at this spot. Within a hundred yards, the tops of the banks consist of solid sandstone rock, so that this conglomerate bed must have been deposited after the formation of a wide chasm, at least forty or fifty feet deep, and several hundreds wide. It is very near the same spot that the horizontal conglomerate occurs, before described. Now, it cannot be supposed that the river formed either of the deposits in question; and it is impossible to doubt that they were deposited before the river existed. Some considerations afterwards to be adduced shew, that, at the formation of these diluvial debris, the whole of this district was covered by water to a height of at least 900 feet above the level of the present sea. It must have been during this state of things (an epoch, of course, prior to the existence of any river, because prior to the existence of dry land), that a hollow or chasm existed to a depth of forty or fifty feet at least, in which this coal, limestone, and greywacke were deposited.

V. It would be improper to conclude this account of the Berwickshire formations, without adverting to some of the more important views which these formations suggest, and of the changes to which this part of our globe has been subjected.

Despite of our wish and intention to avoid, as much as possible, in the previous part of this memoir, any admixture of merely speculative matter, it has been found impossible to describe many of the phenomena, without at least an occasional allusion to the agents by which they were probably produced. The principles on which these explanations rested, were then assumed as true and well founded. It now remains to shew that these principles are well founded.

1st, How has the Lammermuir chain of hills been formed? is the first question which, on looking back upon the preceding narrative, we naturally ask. We see that these rocks,

which (being stratified, and formed of sedimentary matter) must have been originally horizontal and regular in their relative positions, have been upturned, dislocated, and folded over one another, in every possible way. Amidst all this disturbance, however, it would appear that, generally speaking, the direction of the greywacke rocks is east and west, and that they are nearly vertical. Now, these features tally remarkably with the theory by which M. Elie de Beaumont proposes to account for the elevation of mountains. The principle of that theory is, that the rate of refrigeration of the interior parts of the earth has been more rapid than that of its external crust, and that epochs have occurred in the history of our planet, when, on account of the greater contraction of its central nucleus, the crust has been forced up into ridges or mountain ranges. If such dislocations did take place in the earth's crust, they must evidently have extended over extensive areas, and produced, not an isolated mountain, but long chains of hills. Further, it is plain, that the strata thus ridged up would generally be parallel with the great line of dislocation, and that they would be most frequently vertical.

Now, all these circumstances concur in the Lammermuirs. For the great chain of the greywacke hills runs through the south of Scotland, in one direction, which is nearly east and west; and this, in nine cases out of ten, is also the direction of the greywacke strata in Berwickshire. It is true, that there are spots, especially at Fast Castle, Dodsmill, and other places near the central parts of the Lammermuir chain, where the strata, instead of being nearly vertical, or running in an east and west direction, are much twisted and disturbed. But this is just what we would expect to find, if horizontal strata, covering hundreds of miles, were suddenly and violently elevated to an enormous height, in the manner which Elie de Beaumont supposes. The dislocation, when it did take place, would generally be in the highest, and, consequently, the central parts of the ridge or folding.

Geologists have hitherto been accustomed to persuade themselves and others, that such mountain chains as the Lammer-

muirs were raised by trap ; more especially if trap was found in them to any extent. But there seemed to be always great difficulty in supposing, that trap could of itself elevate the long mountain chains which traverse our globe, and more especially still produce the uniformity of direction of the strata ; and then what became of the explanation, when attempted to be applied to those districts where there was no trap at all ? The theory of Elie de Beaumont is greatly more probable, that the trap which occurs among the greywacke strata, has risen up among them, at periods either subsequent to their elevation, or previous to that event. *Partial* dislocations and local elevations, the outburst of trap among the greywacke would undoubtedly effect ; but it is greatly more probable *a priori*, and we are warranted by observation in concluding, that the original elevation of the greywacke strata into long ranges of hills, may be referred to the cause assigned by Elie de Beaumont, and not to the agency of trap rocks.

It would be vain to attempt to form an idea of the epoch *when* the Lammermuir chain of hills rose from their pristine position. It is certain, however, that this event happened at an immeasurable period anterior to the time when the earth became fitted for the habitation of human beings ; for, in the interval, as we shall immediately see, the old red sandstone formation, the carboniferous group of rocks, the new red sandstone, and other more recent deposits, were successively formed ; during all which period, this part of what is now dry land, was covered by the waters of a deep and extensive ocean. If, as Elie de Beaumont's theory assumes, and observations shewing the existence of a central heat lead us to infer, a gradual cooling of our globe has been going on,—that refrigeration must have been at an exceedingly slow rate ; for La Place has shewn that the contraction of the globe in volume, so as to diminish the earth's equatorial diameter by only a few feet in the course of 2000 years, would have been detected by astronomers, whose observations of the celestial bodies extend back for that period of time. Astronomers measure the motion of these bodies by the time of the earth's rotation on its axis ;

and if the earth had contracted in volume, the length of the day must have shortened;—if it had shortened by only the 3000th part of a second, a change would have been produced on the equation of the moon to the extent of 4".4, which would have been easily detected.

After the greywacke rocks had been raised from their original horizontality, it would appear that a series of rocks had been deposited on their edges, consisting chiefly of sand and mud, or silex and alumine,—and greatly impregnated with iron. These are the rocks which we have described as old red sandstones. This state of things continued till after the deposition of the coal-measures, which in Berwickshire lie conformably upon the old sandstone series. Changes of some kind, however, during this period, must have taken place; for among the coal-measures we find, 1st, Many substances which form no part of the old red sandstone, such as lime, magnesia, and coal; and, 2d, a great development of animal and vegetable life, of which there was previously no appearance. It is one department of geology—the most difficult and yet the most seductive—to account for these mysterious changes. The following remarks, accordingly, are offered with much diffidence—to explain the formation of the old red sandstone and coal-measures. It is pretty obvious that the dislocations produced by the elevation of the greywacke rocks,—more especially if it took place at the bottom of an ocean,—would afford abundance of materials, to be washed out from amongst them, and deposited in places more free from the agitation of the waters. The heaviest materials would be first deposited,—chiefly on the sides of the greywacke hills. The finer materials,—such as small gravel, sand, and mud,—would be transported further, and would settle down in a deeper and stiller part of the ocean. We can thus understand the formation of the conglomerates which lie on the flanks of the hills, at pretty steep angles, and of the superincumbent sandstone strata which gradually become more finely granular as they are distant from the hills, and dip at smaller angles. But whence did the old red sandstones derive the iron with which the sediment that formed

its strata must have been charged? Probably from the greywacke rocks; for in many parts along the flanks of the Lammermuirs, numerous veins of iron traverse the greywacke in every direction. One good example may be seen at the foot of Soutra near Blackshiels. In the greywacke rocks, (which there run east and west), veins of red hematite occur several inches in thickness, and almost all the strata are separated from each other by similar veins of iron. At Cowdenknows the same facts are observable. Now, if we suppose that the ocean, in which these old red sandstones were deposited, washed the flanks of the greywacke hills, we shall be in some measure able to account for the deposition of these red metalliferous sandstones.

The numerous impressions of plants which occur in the coal-measures shew that vegetation existed by this time on some part of the greywacke hills. But the growth of vegetables indicates also the existence of dry land; and their remains found in the bottom of a sea, of course, prove that there were rivers to transport these vegetables, and currents in the sea to drift them. The formation of coal-beds still more strongly attests the same facts.

The appearance of numerous molluscous and crustaceous animals for the first time in the coal-measures, is evidently connected with the formation of beds of limestone, from which they were enabled to form their shells.

2d, So much for the *original* elevation of the greywacke rocks from their primitive horizontality.

But it is also a question whether the Lammermuir chain may not have undergone a *second* elevation; for if we suppose that the red sandstones and coal-measures were originally horizontal, how is it that they are all now inclined to the hills at angles varying from 20° to 60° ? If they have been raised into their present positions from a state of horizontality, their elevation, and consequently that of the greywacke range again, must have been enormous, because we find these strata still inclined upwards to the hills, at a distance of fifteen and twenty miles from the Lammermuir chain. This circum-

stance, however, does not of itself render the idea of a second elevation at all improbable ;—for we must recollect (to use the appropriate words of Mrs Somerville) that “ the loftiest mountains would be represented by a *grain of sand*, on a globe six feet in diameter,—and the depth of the ocean, by a *scratch* on its surface.” * But, on the other hand, we should also recollect, that where the bed of a sea declines very suddenly and steeply from the shore, the different strata thereon deposited cannot be horizontal, but will be inclined at pretty high angles. The mere *inclination* of the old red sandstones and coal-measures, is therefore no proof of an elevation since their deposition.

The rents and fractures which have taken place subsequent to their formation across the old red sandstones and coal-measures (rents and fractures which also traverse some parts of the greywacke strata), rather favour the idea of a second elevation of the Lammermuir chain ; for if that chain was again elevated, so as to raise up the more modern strata attached to it, one effect would probably be to produce fractures across these strata parallel to the lines in which that force was acting.

3d, The fact of the *new* red sandstone deposit in Berwickshire and Roxburghshire overlying the edges of the old red sandstones and coal-measures, throws additional weight into the scale in favour of a second elevation of the greywacke rocks.

4th, It must be pretty evident from what has been stated, that, for a period long posterior to the formation of the coal-measures, and of the outburst of those trap hills which upset them, this part of Europe was submerged between the waters of an ocean which was nearly 1000 feet above the level of our present sea.

The upper line of this new red sandstone deposit, if a section were made of it in a direction N. and S., would be found to be nearly horizontal, and having an altitude of about 980 feet above the sea ; but viewed in an E. and W. direction, it apparently slopes gently to the eastward. This fact would indicate the existence of a bay or inland sea, of which the

* Connection of the Physical Sciences, p. 90.

Lammermuir and Cheviot hills formed the arms or capes. The probable *origin* of these horizontal deposits has been already explained. It is unnecessary, therefore, to *revert* to that point.

The present outline and appearance of the plains of Berwickshire, particularly the accumulation of the new red sandstone deposits chiefly on the east sides of the hills, together with the long ridges which trend to the east from these hills, indicates the prevalence of currents from the westward. This view is strengthened by the consideration that the highest parts of the greywacke series, which formed the dry land of that antediluvian epoch, are to the west, viz. in Dumfriesshire and Selkirkshire; and these lofty regions would give rise to numerous streams and rivers, sufficient where discharged into the sea to produce strong submarine currents.

It would appear, that, during the time that this part of the earth's crust was under water, various volcanoes were in action, which must have produced something like an archipelago of islands. It was during this period that all the trap hills of Berwickshire rose; the greater part, however, apparently before the deposition of the new red sandstone.

5th, The next inquiry which suggests itself regards the immense accumulations of sand and gravel which conceal the rock formations. These have evidently been produced by causes different from those which operated in the deposition of the new red sandstone. The latter indicate a quiescent state of waters. The former indicate much turbulence, agitation, and an extensive movement of the whole in a particular direction. That *one* movement *at least*, and *that* the most universal and powerful, must have been from the *westward*, is demonstrated by the dispersion and transport of erratic boulders, whose parent rocks are in that direction;—by the vast weight and size of many of these boulders, which could not have been drifted to their present sites, often over great inequalities of surface, by ordinary submarine currents;—and by the enormous accumulations of sand and gravel over the whole district, which in many cases form ridges or banks of shingle sixty feet high, running nearly east and west.

What catastrophe can be suggested as sufficient to satisfy these conditions? In the first place, is there any event which we know occurred, that *could* of itself have produced them? for if there is, then we are not at liberty to refer them to any separate catastrophe, not otherwise clearly indicated. Now, it will be remembered, that *during* and *since* the deposition of the latest formation in the district, the sea must have stood at a level at least 980 feet higher than at present; by which, therefore, Cockburnlaw, Hume-castle, Stichel Craigs, and Kyles Hill, were entirely submerged, as well as about two-thirds of the Dirringtons, Cowdenknows, and other hills equally high. Either the whole continent, therefore, has been raised up 980 feet, or the waters have subsided to the same depth. That one or other of these events took place is indubitable. The question therefore is, can we by either of them, explain the phenomena presented by the debris of gravel, and the enormous boulders scattered over the district? Let us reflect for a moment on what would be the consequence if either of these events took place? Fragments of stone of various sizes would be torn and swept off from all the hills enveloped by the waters; the bed of the ocean would be violently abraded, and the valleys or hollows previously existing in it would be greatly deepened, the surfaces of the strata which had been deposited would be worn down into hollows or valleys, all trending from the hills, and immense accumulations of detritus would accompany the onward movement of the waters. If the *ocean subsided*, then the direction of that movement would be towards the *east*, on account of the Lammermuir and Cheviot chains, running towards the east, and the gradual slope of the bed of the sea being in the same direction. If we suppose, on the other hand, that *the land rose*, then exactly similar effects would follow, provided the whole district was equally and uniformly raised.

But is it impossible for us to say, which of these events it was that happened? It would seem that the *subsidence of the waters* is the best calculated to explain the phenomena, at

least of this particular district; for if the whole continent had been lifted up 980 feet, it is hardly possible to suppose, that the most tremendous dislocations would not have taken place in every part of the district; and instead of our now finding great tracts covered by soft and slaty sandstones, and by beds of sand and clay, perfectly horizontal, and traversed by but few faults or rents of any kind, we should find that formation disrupted, fractured, and distorted in every direction. Those beds of conglomerate, too, such as are at the Pease Burn and Burnmouth, which extend for considerable distances, would, in that case, hardly present the regularity, uniformity, and horizontality which they now possess.

We conclude, therefore, that the phenomena of this district, so far as they have been yet observed, are best accounted for by supposing, that it was formerly the bed of an ocean which washed the sides, if it did not reach to the tops of the Lammermuir and Cheviot ranges:—that since the deposition and formation of the new red sandstone group, there has been a subsidence or sinking of that ocean to the depth of at least 980 feet;—that it was this event which occasioned the vast accumulations of sand and gravel that generally go by the name of diluvial debris:—and farther, that no catastrophe of a like extensive and destructive nature has subsequently occurred on this part of our globe.

III. Mineralogy.—There are few minerals in the district which are important in any respect. But those which do occur will now be briefly noticed, and in the order of their greatest abundance.

1st, *Alumina* or argillaceous earth occurs in the greatest abundance in the greywacke rocks. It probably composes about a half of their whole volume. The beds of alum-shale which occur on the south ridge of Soutra and on the Ale Water, have been already noticed.

Of this mineral the shales and beds of clay in the coal-measures are, in a great measure, composed; a good deal of it is also found in the old red sandstone, and it occurs in small quantities in the trap-rocks.

2d, *Silica* or quartz is the next in abundance. It is extensively diffused through the greywacke; and, with alumine combined, goes far to compose the whole rock. The extensive deposits of sandstones in the subsequent formations contain a prodigious quantity of siliceous matter. In the sandstones of the coal-measures are found hard concretions called by the workmen "yokes," and sometimes "bastard whin." They have generally the shape of an oblate spheroid, and lie parallel with the plane of stratification. Sometimes these concretions are pear-shaped, as in the quarries at Norham.

3d, *Felspar* is a mineral chiefly or exclusively found in trap; and, considering the number of trap hills in the district, consisting of felspar-porphry alone, without reference to others, in the composition of which it forms an important ingredient, felspar must be immensely abundant.

4th, It is curious that *Lime* does not occur either in the greywacke series or in the old red sandstone group. We have seen, however, that it pervades the coal-measures in large quantities, but that it again ceased to be deposited when the new red sandstone sea prevailed.

In the coal-measures it forms thick and extensive strata in their upper parts, and is only faintly diffused through the beds of shale and of marl, characterising the lower parts of the series.

5th, *Magnesia* is found in considerable quantity, but only among the coal-measures. At Hadden, where the Chert Limestone (previously described), was worked for sale, it was combined in the proportion of 6.25 of carbonate of magnesia, and of 5.25 of carbonate of lime, or nearly equal parts;* and the analysis of the same rock from Birgham Haugh, already given, affords nearly the same results. Its occurrence in the seams of coal worked near Berwick has been already noticed, and there it is combined with alumina and oxide of iron.† *Magnesia* occurs also in the trap-rocks.

6th, *Gypsum* or sulphate of lime is found in the beds of

* New Statistical Account of Scotland—Eccles Parish.

† Analysis by Professor Christison for the author.

blue clay which form the lower parts of the coal-measures. There are three varieties of it,—Red Fibrous Gypsum, White Fibrous Gypsum, and Selenite.

The red gypsum is found in lumps or irregularly-shaped nodules, from the size of an almond to four times that size. It occurs at Burnmouth and at Birgham, in the same beds with the white gypsum.

The white gypsum is found in thin seams or veins, not more than two inches thick, but generally only half an inch thick. It is found near Hutton Hall on the Whitadder banks, near Hirsell on the Leet, near Fleurs on the Tweed, as well as at Birgham and Burnmouth. It was also found at Milne-Graden, when trials were made there for coal. The veins run in all directions through the clay beds. The clay deposit always shews derangement or disturbance along the line of gypsum veins, and there is every appearance of those veins having been formed by an infiltration of calcareous matter into small cracks or slips which have taken place in the clay. The veins of white gypsum are often *intersected* by nodules of red gypsum; but which of the two was the most recently formed, this circumstance hardly enables us to tell.*

7th, *Selenite* is found generally attached to the nodules of red gypsum; but it occurs also by itself in cracks in the beds of clay or marl, especially where these cracks are exposed to the influence of the weather. Crystals, nearly transparent, and about an inch long, have been got in the cliffs about a mile and a half above Tweed Mill.

8th, *Steatite* or soapstone has been found both in the greywacke and in trap. Good specimens of the former rock, con-

* Sulphate of lime abounds in all the lower parts of Berwickshire. There is hardly a well or a spring which does not hold a large quantity of it in solution. The well water at Eccles Manse, for instance, contains 58 parts out of the 100, for every imperial gallon (*Stat. Account*). The petrified moss, so commonly met with on the banks of the Tweed and Whitadder, is an incrustation on the moss and grass, through which water oozes, holding sulphate of lime in solution. Owing to the evaporation of the water, when it is exposed to the heat of the sun or of the air, a portion of the sulphate is precipitated.

taining this mineral, may be got in the upper parts of Dunglass Burn. It occurs also in thin veins in the felspar porphyry of Lamberton Hill, quarried near Nunlands, and in the claystone porphyry which forms the dike at Cumledge.

Common *salt* occurs in the district, not indeed in a mineral form, but in springs, which hold it in solution. For example, the well water at Eccles Manse, contains about 30 parts in the 100 of common salt in every imperial gallon. In the well near Dunse, called the Dunse Spaw, formerly celebrated for its medicinal virtues, there was found, on analysis, to be a large proportion of common salt.

Many other minerals occur, especially in the trap-rocks of the district, which do not here deserve any special enumeration.

The only *metals* that have been discovered are iron and copper.

The iron occurs both in the aqueous and in the igneous rocks, but chiefly in the former. It occurs in the greywacke rocks in numerous veins, which intersect them in all directions, but which most frequently run between the several strata. They seem to be no more than cracks in the rock, into which the oxide diffused through the rock has filtered. It seldom gives a red colour to the greywacke; on the contrary, the external surface of the rocks is stained black with it.

It is iron which, probably in a state of peroxide, gives to the red sandstone groups their high red colour. It does not occur in veins in these measures; but it seems to have generally, and pretty uniformly, impregnated the whole sediment.

Among the coal-measures, thick beds of a dusky red sandstone occur, that are filled with nodules and veins of iron-ore. Along the shore at Dunglass, and in the channel of Dunglass Burn near Oldhamstocks, the quantity of this metal is enormous; it seems surprising that no experiment should ever have been made to work it.

The only place where the iron has been noticed in trap is on the hill south of Greenlaw; it occurs in the current of trap which has flowed in that direction from Hume Castle.

Copper is also found both in the aqueous and in the igneous rocks. It occurs in the greywacke at Ordweel, Fassney, and near Elmford. It has also been noticed in the channel of the Brunta Burn, below Dods Mill. About sixty years ago the copper vein at Ordweel was worked by an English company to a considerable extent; and in 1825 the workings were resumed, but without success. There are two veins near Ordweel; their direction is N. 85° E., and they appear to run in the heart of the greywacke strata.

The felspar porphyry which supports the conglomerate at Eyemouth contains copper. Its presence is indicated by the green patches on the surface of the rock, caused by the oxidation of the metal.

IV. Connection between the *Geology* and the *Agriculture* of Berwickshire.

1st, It is hardly necessary to add much to what has been already said, of the origin of the soils of Berwickshire. In some places they are formed exclusively by the disintegration of the rocks beneath; in other places, of the debris arising from the wearing down of rocks in more distant places. In the higher parts of the country, particularly those parts occupied by the greywacke series and red sandstones (both old and new), the soil depends *generally* on the nature and composition of the subjacent rocks; and even in the lower parts of the country where the coal-measures crop out, but where there is a prodigious accumulation of alluvial debris, those rocks still frequently determine the peculiar character of the incumbent soil.

The elements of all soils, from whatever quarter derived, must therefore be principally alumina, silica, carbonate of lime, felspar, magnesia, and iron; for it is of these substances that the rocks of the district almost entirely consist. The differences in soils are caused by various combinations of these simple substances.

Now it is found that all soils in whatever proportion their elements are mixed, are nearly equally productive—though

it is only soils of particular descriptions that will produce most abundantly and luxuriantly *particular kinds* of plants. The *cause* of this, science has not yet explained—the *fact only* is known, that particular soils are characterized by particular plants, and are most capable of producing and nourishing them.

Mr W. Smith, so deservedly denominated the Father of English Geology, and who spent about forty years in constructing a Geological Map of England, at last became so familiar with the plants and grasses, which were the most abundantly produced by different formations, that he could often tell as he travelled through a country, what *rock formations* he was passing, by observing the plants and shrubs growing on them; and the author of this memoir, in an excursion which he once had the good fortune to make in company with this remarkable individual, has heard him name, with surprising correctness, on merely observing from a carriage window the plants growing by the sides of the road, what were the different formations we were passing.

Every one, however, unacquainted with geology or botany, must have remarked, that the common *broom* grows more frequently, and to a greater size, on a sandy soil than on any other: that *whins* thrive better on a rich clay soil (such as that produced by the disintegration of argillaceous rocks) than on a sterile sand. But the following passage from the Flora of Berwick-on-Tweed, illustrates this subject still more forcibly. The author is alluding to the *grasses* which he found near St Abb's Head, and particularly in the valley which we have already described,* as consisting on the east side entirely of trap, and on the west of greywacke. Dr Johnston remarks, that “there is a difference in the botany of the two sides of the valley;” and *that* “sufficient to attract the notice even of the most superficial observer. For instance, the *Arenaria verna* grows among the unstratified trap of the ‘Head,’ in the most beautiful luxuriance; while on the opposite side of the valley, though the distance in one place be not more than a few yards, not a specimen is to be seen. The *Hype-*

ricum humifusum again we observe in considerable abundance, on the stratified side; while on the other, we do not meet with it, and the same remark I have made in similar situations elsewhere. It may be curious also to observe, that the *Pri-mula elatior*, as well as the common cowslip, although abundant among the rocks on the *greywacke side*, are not met among those of the *opposite side*—a remark which holds good in other parts of the district, comprehended in the following Flora.”*

Why is it that the trap hills of the Cheviot range are so celebrated for their rich pastures, and the excellent sheep which feed on them? And how is it that in Berwickshire, as in every other part of Scotland, the *trap hills* afford better pasture than the *greywacke* hills? Why is it that, generally speaking, the most luxuriant crops are produced in the *new red sandstone districts*?—and that the Lammermuir Hills, notwithstanding the greater coldness and wetness of their climate, and the ruggedness of their rocks, are capable of yielding grain and turnips? Why is it that, on the other hand, the *coal-measures*, though situated so near the level of the sea, are often marked by a bleak and sterile soil? The reason will be obvious, when we attend to the composition of these rocks, and their other geological features.

The *red sandstones*, and particularly the new red sandstones, are generally composed of a mixture of silica, alumina, and iron. They are soft in texture; and thus by their easy disintegration, produce a finely comminuted soil;—and this readiness to pulverise, is increased, by the tendency of the iron in the strata to combine with oxygen from the atmosphere. They are also extremely porous, and thus the water escapes readily from the soil which covers them.

It is curious to observe, how completely these remarks as to the fertility of the red sandstone groups, are verified by the excellent crops which are grown in Lauderdale, and in most of the smaller valleys and ravines, which branch up from the Leader among the greywacke hills. Most of these valleys are

* Flora of Berwick-on-Tweed, by George Johnson, M. D
VOL. XI. (T)

filled by the red soil of the red sandstone groups; and in consequence, though surrounded on all sides by lofty and precipitous hills, these valleys are remarkable for the abundance and richness of their harvests.

The soil of the *red sandstones*, for the reasons above stated, seems to be, in general, more prolific than the soil yielded by the shales and marls of the *coal-measures*. There is in the latter too large a proportion of alumina, in consequence whereof they form stiff clay soils, which, on the one hand, do not readily absorb moisture from the atmosphere, and are therefore in dry weather burnt up; while, on the other hand, they do not suffer the water which falls on them to escape, and are therefore too much saturated with water when the weather is wet.

The *greywacke rocks* are so hard and compact, that if they were horizontal like the newest rocks, water falling on their soil would constantly keep it wet. But they are fortunately vertical, and thus the water which gets into the soil, is enabled at once to reach the edges of the strata, and to escape through between them. Farther, if the greywacke rocks had been horizontal, the action of the weather would have had little or no effect in causing disintegration; but in consequence of their edges being all turned up, they are more liable to be acted on by moisture and frost; and they are thus broken down into a soil, well adapted for cultivation, by its proper proportions of silica and alumina.

The soil which covers the greywacke rocks, it is true, is of no great depth. In a crop of turnips growing on the greywacke formation, it is sometimes possible even to trace the direction, and follow the edges of the strata underneath. The turnips will often, in *parallel lines*, be seen to be alternately large and luxuriant, or small and unhealthy; and these lines are coincident with the edges of the subjacent strata. The explanation is this:—some of the strata being of a slaty structure, enable the water to run off, and at the same time more readily to decompose into soil than other strata; and hence along the edges of the former, the soil will be drier and deeper, and consequently the turnips better, than along the edges of more compact strata.

The *trap hills*, in like manner, especially the felspar and claystone porphyries, easily imbibe moisture, and by the action of the weather, produce a clay soil capable of producing rich green pastures on their surfaces. But many of the *strata* among the *coal-measures* produce, on the other hand, a very infertile soil. This quality is supposed to arise from the abundance of iron-pyrites in them. The coal-measures in Berwickshire, generally speaking, afford a stiff clay soil, (arising from the disintegration of shales), which is fortunately not impregnated with sulphuret of iron. On the south of the Tweed, however, a marked difference of character prevails in the soils and vegetation of the country.

In reference to this subject, viz. what are the soils which are the best adapted for particular plants and vegetables,—the experiments which were reported to the Highland and Agricultural Society, at its annual meeting in 1835, as being now carried on by his Grace the Duke of Buccleuch, are of great importance. The object of these experiments is to ascertain, by mixing the usual ingredients of soils in different proportions, and growing particular crops on them, what is the soil best suited to them. The most important benefits to agriculture may be expected to accrue from the experiments.

2d, The connexion between agriculture and geology being thus so close and apparent, the only remaining question is, in what way can a knowledge of geology be rendered practically useful to the farmer? A few observations may now be added on this head.

(1.) The farmer, knowing, from experiments or observation, the soils which are best fitted for agricultural purposes, should ascertain what the rocks are in any particular district, and whether they are such as are likely to produce, by their disintegration, rich and abundant crops. If the rocks are entirely siliceous, he ought to add alumine and carbonate of lime in certain proportions to the soil, in order to effect a proper admixture. If, in like manner, there is too much argillaceous matter supplied by the subjacent strata, in consequence of which the soil is wet and otherwise unfavourable, then he should correct the evil by the addition of sand.

But how little are these things attended to by farmers ! The only mineral substance which they ever think of adding to their land is *lime*, and that without any attempt or desire previously to find out, whether there may not be already more than enough of calcareous matter in the soil, and whether it would not be less expensively and more effectually improved by the mixture of some other substance.

(2.) The agriculturist, if he knows the *formations* in different parts of the country, with the character of which he is not otherwise acquainted, is thus enabled to select that part which is most likely to yield a fertile soil ; and the same remark which applies to a person who is about to commence *farming* operations in an unknown district, applies also to the case of a person purchasing an estate. If he is desirous of having land capable of yielding luxuriant crops, he will prefer the new red sandstone district, and avoid the coal-measures. If he is in search of rich sheep pastures, he will select the trap hills and not the greywacke, far less the granitic chains. Such information may, no doubt, be of less use in a country like Great Britain, where every facility exists for the examination of the soil itself ; but it is easy to see how a knowledge of the rock formations may, both to farmers and intending purchasers, be of the greatest use in unknown regions of the earth, such as Canada, America, and New South Wales, where no other means exist of discovering previously the productiveness of the land.

(3.) Nothing to the farmer is so important as a knowledge of the causes of wetness and dryness in the soil, and of the means which he should adopt to correct any excess of either. Some of his crops may bear or require a drier soil than others ; and if he knows the nature of the rocks which occur in different parts of his farm, he will also know those parts of it where the water will easily escape of itself through the subjacent strata, and those where he must himself supply those means of drainage which nature has denied. At the same time he is enabled to select those parts of the soil which, by their natural dryness or moisture, are the best adapted for particular crops.

(4.) A knowledge of the position of the strata also enables the farmer to obtain a supply of water when he requires it, and thereby to save him much trouble and expense in searching for it. For if he makes himself acquainted with the nature, direction, and dip of the rocks, he can tell in what direction the water which filters through the soil will run, and whereabouts it will probably burst out in the form of a spring.

It is known to Berwickshire farmers, that drains which run in a north and south direction, do not carry off from the land one-half the quantity of water, which drains running east and west carry off. One reason probably is, that as in the former case the drains cross the croppings of the strata, the water escapes between their edges; whereas the drains that run east and west are parallel with the edges of the strata. Another reason may be found in the fact, that the greater part of Berwickshire consists of undulating ridges, which run east to west;—so that the drains that are cut in that direction are necessarily longer, and collect more water than the drains which cross these ridges.

(5.) To an agriculturist, and especially to landlords who are anxious to improve their estates, by building offices and walls, a knowledge of the places where good building materials may be found and quarried, is of the greatest consequence. But without some acquaintance with the nature and relative position of the rocks in a district, it is quite impossible to discover the particular spot where stone can be found, and to what depth it must be bored for.

These are a few of the most obvious advantages which would result to agriculturists, if their art were aided by a knowledge of geology. Into this subject, however, the author forbears to enter at greater length; for he finds that his paper has already exceeded all reasonable limits. But enough has been said, it is hoped, in the brief though imperfect sketch which has been given, to shew the great expediency of promoting that union between the sciences of Geology and Agriculture, which it is the patriotic object of the Highland and Agricultural Society of Scotland to effect.

DESCRIPTION OF A SYRINGE FOR SMEARING AND BATHING SHEEP. *By Mr ROBERT NISBETT, Innerleithen.*



THIS syringe consists of a brass hollow tube *a*, about eighteen inches in length. That used for smearing is a quarter of an inch internal diameter, terminating with an obtuse conical point of iron *e*. The piston-rod *b* is an iron wire, having a button handle *c*, with the usual stuffing at the working end. An aperture *d*, of an eighth of an inch in diameter, is made in the side of the brass tube, near the end to which the iron point is attached for the taking up and discharging the smearing liquid. Such a syringe is adapted to the smearing of sheep with a prepared ointment, which should be made thinner than the ordinary smearing ointment. Mr Nisbett recommends the ointment to be composed of one pound of black soap and thirty-two pounds of tar, with a sufficient quantity of water, or, what is better, of soap suds, to make it thin enough. The syringe for applying bath is of the same construction, but of larger diameter. Both the syringes are used thus:—Immerse the aperture *d* in the smearing liquid or bath; draw a full stroke of the piston-rod, when the tube will be filled with the liquid. In applying the instrument, the shepherd, instead of shedding the wool, as in the ordinary way, introduces it among the roots of the wool, with the aperture *d* next the skin, and pushes it forward in a direction parallel with the body, the blunt point bearing on the skin until the whole tube is hid amongst the wool: hold the handle of the extended piston-rod steady in one hand, whilst with the other pull the tube towards you, and the liquid will be deposited in a line, and thence spread itself over the skin. Mark the line bathed with a feather till another line is finished. A man and a boy or girl are required

to bathe or smear one sheep. An ordinary sized sheep can be bathed with this syringe in five, and smeared in twelve minutes. Mr Nisbett represents the process to be as well, and more quickly performed, than by the ordinary method. The advantages which he represents this method to possess are, that the fleece is not broken by shedding, and therefore remains impervious to the wind, and the operator is kept clean. Certificates of the efficacy of Mr Nisbett's syringe for smearing were sent to the Society by Mr Francis Scott, Traquairknow; and for bathing by Mr George Learmont, Traquair House, and Mr David Taylor, Cabberstone; all of whom attest that the sheep were bathed and smeared as well with it as they could have been by the most expert shepherd in the ordinary way.

[The Society's Silver Medal was voted to the authors of the two following papers, for the introduction of new or valuable plants into the field culture of this country.]

ACCOUNT OF THE *VICIA VILLOSA*, A SPECIES OF TARE NEW TO THIS COUNTRY. *By Mr A. GORRIE, Annat Garden.*

THE *Vicia villosa* is a plant, I believe, new to the agriculture of this country, and from its luxuriant growth and fertility in seed-bearing, it appears deserving of culture as a tare. Of this plant I procured a few seeds in November 1833, picked out of a sample of Danzig wheat, with a view to ascertain the agricultural weeds in the north of Europe. They consisted of *Agrostemma Githago*, *Vicia sativa*, *Centaurea Cyanus*, and the *Vicia villosa*. The rapid growth of the latter excited attention. A plant with ripe seed was sent last year to the museum of Messrs Dickson and Turnbull, Perth, and one to the museum of Messrs P. Lawson and Sons, Edinburgh. The seeds of the remaining four plants were sown this year which have produced 8 lb. of seed.

The plant is quite hardy and stands the winter. If sown in October or early in March it will come into flower in the beginning of July, at which time, although the plants originally

should stand nine inches separate, it will form a dense mass of succulent herbage, of which cattle and horses are exceedingly fond. I may mention, that this plant is quite different from the *Vicia pseudo-cracca* to which it may be supposed to bear some resemblance.

[According to Loudon, the *Vicia villosa* is an annual vetch indigenous to Germany, grows three feet high, and flowers in June and July. It was introduced to Britain in 1815. Mr Lawson sowed the seeds sent him by Mr Gorrie on the 10th April. They produced flowers on the 20th July, and a full crop of ripe seed in the last week of August. The average height of the plants was about eight feet, and the forage thus yielded was about double the quantity of the common tare. It may become a valuable forage plant in spring, at a time when green food is often very scarce.]

ACCOUNT OF ALSIKE CLOVER (*TRIFOLIUM HYBRIDUM*.) *By*
Mr GEORGE STÉPHENS, Land Drainer, Edinburgh.

THIS plant was first discovered growing luxuriantly on the sides and in the bottoms of ditches, at Alsike Inn, ten miles from Upsala, in Sweden. It was named, classed, and fully described by Linnæus, in his *Flora Suecica*, at page 258. It has since been described in the botanical works of Liljeblad, Hartmann, and Wahlenberg, and of some Danish and German authors. Its trivial name, *hybridum*, is derived from its appearance being something between that of the common red clover (*T. pratense*), and the common white (*T. repens*); but it is quite a distinct species, and easily distinguished from both; nor does cultivation alter its character. It was supposed to have originated from the accidental union of those two species, and it is probably for this reason that it is called Bastard clover, in the second volume, No. 129, of *Swedish Botany*, where it is accurately delineated, and its usefulness as an agricultural plant fully described. It is also described in the *Swedish Royal Patriotic Agricultural Society's Journal* of 1780 and 1782, as a plant well worthy of the atten-

tion of agriculturists. Its properties of growing higher, having its leaves more luxuriant, and striking its roots deeper, and remaining longer in the ground than the common clover, render it not only suitable for hay, but for laying down land to permanent pasture. The hybridum grows wild in Finland, Denmark, Germany, France, the northern part of Italy, and Portugal; but it has never been discovered growing wild in Great Britain. It is likewise partially cultivated in Denmark, Flanders, Finland, and some of the German States, where its hay is generally mixed with straw; in which state it retains its colour and smell, and never moulds. I have known the plant a considerable time, but never paid particular attention to it, till during my annual visits to Sweden in the last three years, when I observed its growth, and the soil on which it thrives best. Its natural soil is a calcareous loam, which effervesces with vinegar. When cultivated, it grows well in mild soils that are properly managed. Baron Wrangel of Akerby, in the province of Nericia, who has cultivated it for more than twenty years, says that, "if sown in well managed land of not too strong a nature, it yields a crop of hay of from 360 to 540 imperial stones per imperial acre, for ten or fifteen years successively, but the land must not be grazed by sheep or horses during the first two or three years." The seed is sown early in spring, before the ground gets too dry or the wheat too strong (being sown among wheat or rye), and it comes to perfection the third year; but as the crop is often heavy, and when the weather is showery, it is inclined to fall down, a small quantity of Timothy-grass seed (*Phleum pratense*) is generally sown along with it, to support it and insure a full crop in the second year. The cause of its failure in the second year, in Sweden, is, that the summer months being generally very dry, the drought prevents part of the seed springing till the autumn or following spring. But the climate of this country being more moist, it is reasonable to expect that the whole of the seed sown will spring at the same time, and consequently produce a good crop the second year. The roots of this species of clover, going deeper into the soil

than those of the clover plants now in use in this country, will enable it to resist the uprooting effects of the alternate sunshiny days and frosty nights which prevail here in March and April. This plant throws up many stalks from the same root, which are not so strong as the common red clover, but stronger than the white, and having more lateral branches than either. The lower part of the flower is white, fringed round the upper extremity with a red ring, which gives the plant when in full flower a beautiful appearance. The plant possessing these hardy characteristics in Sweden, there cannot be a doubt of its being a perennial, which will stand our changeable climate better than any other trifolium hitherto cultivated in Great Britain, and with our superior agriculture, the crop will be here equally, if not more productive, than in its native country. All kinds of stock eat it eagerly, either in a green or dried state, which is a sure indication of its nutritive properties. I sent a small quantity of the seed to the Highland Society last year, which Mr Lawson informs me he has cultivated with success, and I also distributed some among various gentlemen for the purpose of experiment.

[The genuine Linnean plant of this name does not grow naturally in Britain, Sir James Smith having ascertained that the *T. hybridum* of Hudson's *Flora Anglica* was not the plant of Linneus. Mr Lawson has cultivated a small quantity of this clover for two years at Meadowbank Nursery. In the first year the seed was sown on the 17th April 1834, produced flowers on the 25th August, and ripened the seed early in October, the height of the plants being twenty inches. In 1835 the same plants were in full flower on the 18th June, and ripened seed early in August, the height being two feet. The forage was abundant, and eaten greedily by a horse. Its botanical characters are:—head globular; stalked; pods four-sided; tuft of the calyx nearly equal; leaflets ovate, and a little serrated; stems branchy; habit of growth not so upright as red clover; root fibrous. Loudon states its introduction into Britain in 1777, and that it is described in *Michelis' Nova Genera Plantarum*.]

REPORT MADE TO HIS GRACE THE DUKE OF BUCCLEUCH AND QUEENSBERRY, RELATIVE TO THE AGRICULTURAL GARDEN FORMED AT SMEATON, IN DALKEITH PARK, BY ORDERS OF HIS GRACE. *Communicated to the Highland and Agricultural Society of Scotland by directions of the Duke.*

THE agricultural garden at Dalkeith Park was laid out by desire of his Grace the Duke of Buccleuch, in spring 1834, for the purpose of growing the various kinds of agricultural plants, with the view of ascertaining their relative values and adaptation for the different uses or purposes to which they are or may be applied.

The class of agricultural plants to which attention has hitherto been chiefly directed, and that which forms the subject of the present communication, is the *Hay and Pasture Grasses*. That portion of the Garden appropriated to the culture of these is laid out into square patches, each containing about $22\frac{1}{2}$ yards, and separated by intervening walks, four feet in breadth, which cross each other at right angles; and a portion at one side, which is overshadowed by large trees, is laid out into smaller compartments, for the purpose of ascertaining what sorts are more particularly adapted for growing under the shade and drip of trees. Another portion, laid out in the same manner as that occupied by the grasses, is allotted for the clovers and other *forage and herbage plants*. And the rest of the garden is occupied by the cereal grains, turnips, &c, all of which are cultivated in drills, and may form the subjects of future communications, should this be deemed at all interesting.

The seeds of the various kinds of grasses enumerated in the following table, were sown in spring 1834. Several new or rare sorts have been added since, but have not as yet attained that state of maturity which would warrant their occupation of a place along with those of longer standing.

TABLE, shewing the result of the Observations made at the AGRICULTURAL GARDEN in DALKEITH PARK in 1834 and 1835.

GENERIC AND SPECIFIC NAMES.	SEASON 1834.		SEASON 1835.						
	Average height in inches.	Length of the Young Foliage in March, 1st March.	Time of Flowering.	Time of Ripening Seed.	Entire height, in feet.	Height of the Aftermath cut when in flower, in inches.	REMARKS ON AFTERMATH OF PART CUT WHEN IN FLOWER.	Height of the Aftermath cut after ripening seeds, in inches.	REMARKS ON AFTERMATH OF PART CUT AFTER RIPENING SEED.
<i>Agrostis alba</i> .	12	1 to 2	July 21.	Aug. 22.	1½ to 2	8 to 10	No flower-stalks	4 to 6	No flower-stalks
<i>capillaris</i> .	14	1 ~ 2	24.	26.	2	10	Do.	4 ~ 6	Do.
<i>dispar</i> .	15	3 ~ 4	21.	25.	2½ ~ 3	10 ~ 12	Do.	6 ~ 8	Do.
<i>spica venti</i> .	24 to 30	none		Sept. 3.	1 ~ 1½	3 ~ 4	Do.	3	Do.
<i>setacea</i> .	3 ~ 4	3 ~ 4	Aug. 21.	22.	2 ~ 2½	10	Do.	6	Do.
<i>stolonifera</i> .	14	none	18.	22.	4 ~ 5	12 ~ 15	Do.	6 ~ 8	Do.
<i>Aira caespitosa</i> .	16	4 ~ 6	June 18.	July 14.	3½ ~ 4	23 ~ 34	Flowered, and partly ripened seeds	15 ~ 20	Flowered sparingly
<i>lutescens</i> .	24 ~ 30	4 ~ 6	July 3.	25.	2½	3 ~ 4	Tufted bristly foliage	3	{ Differs little from part cut
<i>flexuosa</i> .	3	none	May 25.	June 26.	3 ~ 4	12 ~ 24	Produced a very few flower-stalks	8 ~ 10	3d July
<i>Alopecurus pratensis</i> .	12 ~ 15	6 ~ 8	20.	25.	1½ ~ 1½	6 ~ 12	Do.	4 ~ 6	Produced only root-leaves
<i>Anthoxanthum odoratum</i> .	6 ~ 12	3 ~ 4	July 3.	July 25.	1½ ~ 5	36 ~ 42	Flowered, and partly ripened seeds	18 ~ 24	Do.
<i>Arrhenatherum avenaceum</i> .	30 ~ 36	4 ~ 6							Flowered sparingly
<i>Avena flavescens</i> .	24	4 ~ 6	21.	Aug. 4.	4 ~ 5	12	Produced no flower-stalks	6	No flower-stalks
<i>Bromus giganteus</i> .	15	1 ~ 3	June 21.	July 24.	1 ~ 1½	6 ~ 8	Do.	4 ~ 6	Do.
<i>Cynosurus cristatus</i> .	6 ~ 10	30 ~ 36	18.	21.	4 ~ 5	24 ~ 36	Partly flowered	12 ~ 18	Produced chiefly root-leaves
<i>Dactylis glomerata</i> .	30 ~ 36	none	July 10.	Aug. 10.	4	15 ~ 20	Much rusted	10 ~ 12	Much rusted
<i>Elymus alpicus</i> .	10 ~ 12	2 ~ 3	June 20.	July 20.	2½	12 ~ 18	Produced a few flower-stalks	6 ~ 8	Produced chiefly root-leaves
<i>Festuca duriuscula</i> .	6 ~ 10	2 ~ 3	July 18.	Aug. 8.	4 ~ 5	18 ~ 24	Do.	12 ~ 15	Do.
<i>elatior</i> .	24 ~ 30	6	June 24.	July 21.	4 ~ 4½	12	Chiefly root-leaves	6 ~ 8	Produced entirely root-leaves
<i>heterophylla</i> .	8 ~ 10	3 ~ 4							

TABLE of Observations—continued.

SEASON 1834.		SEASON 1835.							
GENERIC AND SPECIFIC NAMES.	Average height in inches.	Length of the Young Foliage, 21st March, in inches.	Time of Flowering.	Time of Ripening Seed.	Entire height, in feet.	Height of the Aftermath of portion cut when in flower, in inches.	REMARKS ON AFTERMATH OF PART CUT WHEN IN FLOWER.	Height of the Aftermath cut after ripening seeds, in inches.	REMARKS ON AFTERMATH OF PART CUT AFTER RIPENING SEEDS.
<i>Festuca loliacea</i>	20 ~ 25	4 to 5	July 18.	Aug. 4.	4	15 to 18	Produced a few flower-stalks	10 to 12	Produced chiefly root-leaves
<i>ovina</i>	3 ~ 4	1	June 18.	July 16.	1½	6 ~ 8	Chiefly root-leaves	3 ~ 4	Do. entirely do.
<i>pratensis</i>	20 ~ 25	4 ~ 5	July 18.	Aug. 4.	4	15 ~ 18	Produced a few flower-stalks	10 ~ 12	Do. chiefly do.
<i>tenuifolia</i>	3 ~ 4	1 ~ 1½	June 18.	July 16.	1	6	Entirely root-leaves	3 ~ 4	Do. entirely do.
<i>Glyceria fluitans</i> , var.	18 ~ 24	3 ~ 4	June 18.	July 20.	2 to 2½	12 ~ 15	Produced a few flower-stalks	8 ~ 10	Do.
var.	10 ~ 15	3 ~ 4	June 18.	July 20.	1½ ~ 1½	6 ~ 8	Do.	3 ~ 5	Do.
<i>Holcus lanatus</i>	18 ~ 24	2 ~ 3	June 25.	July 23.	2½ ~ 3	12 ~ 16	Do.	6 ~ 8	Do.
<i>Lolium italicum</i>	36 ~ 40	6	June 28.	July 18.	3 ~ 4	36 ~ 60	Ripened seeds 24th September.	30 ~ 36	Ripened seeds
	15 ~ 24	1 ~ 2	June 26.	July 22.	2 ~ 2½	24 ~ 28	{ Flowered irregularly, and ri- pened some seeds	18 ~ 26	Flowered sparingly
<i>Lolium perenne</i>	18 ~ 26	2	June 26.	July 20.	2½	28	Do.	22	Do.
	18 ~ 24	2	June 26.	July 20.	2½	28	Do.	22	Do.
	16 ~ 24	1 ~ 2	June 30.	July 22.	2½	26	Do.	20	Do.
	24 ~ 28	2 ~ 3	June 30.	July 24.	2½	28	Do.	20	Do.
<i>Poa annua</i>	4 ~ 6	2 ~ 2½	June 26.	July 30.	2½	23	Do.	12 ~ 20	Do.
<i>memoralis</i>	4 ~ 6	2 ~ 3	All	Seasons.	½ ~ ¾		Ripened seeds		
<i>nerata</i>	15 ~ 18	4 ~ 5	June 20.	July 21.	2½	24	Do.	15 ~ 20	Flowered irregularly
<i>pratensis</i>	15 ~ 18	4 ~ 5	June 22.	July 20.	2½	28	Few flower-stalks	18 ~ 20	Do. pretty regularly
<i>trivialis</i>	6 ~ 10	5 ~ 6	May 23.	June 8.	2	15	Ripened irregularly	8	Chiefly root-leaves
<i>Phleum pratense</i>	18	3 ~ 4	June 18.	July 28.	2½	20 ~ 24	Do. a few seeds	15 ~ 18	Flowered irregularly
	18 ~ 24	2	July 21.	Aug. 8	3 ~ 3½	28 ~ 34		20 ~ 24	Do.

In the foregoing tables, those on pages 260 and 261, the first column contains the Latin generic and specific names of the plants experimented on; the second column, under the head "Season 1834," shews the *produce* of the various kinds in the same season they were sown. The tables on pages 262 and 263 contain remarks on the *state* of the plants in 1834 and 1835, such as habits of growth, appearance, &c.; the names of the various kinds of plants being given both in Latin and English. All the columns under the head "Season 1835," in the tables on pages 260 and 261, shew the comparative produce of the different plants enumerated, in spring, time of flowering, time of ripening seed, entire height, height of the aftermath of the portion cut when in flower, remarks on the aftermath, of the part cut when in flower, height of the aftermath cut after ripening the seed, and remarks on the aftermath of the part cut after ripening the seed.

Of those sown under the shade and drip of trees, the following sorts seem best adapted for such situations, viz. *Poa Nemoralis*, *Poa trivialis*, *Dactylis glomerata*, *Festuca elatior*, *Bromus giganteus*, and *Holcus mollis*; and of these the *Poa nemoralis* is entitled to pre-eminence, not only as being the best adapted for growing in very much shaded situations, but also on account of the fineness and superiority of its produce. *Poa nervata* is said to be almost as suitable, but it has not yet received a fair trial. Besides the preceding, the *Anthoxanthum odoratum*, *Cynosurus cristatus*, *Phleum pratense*, and *Aira cæspitosa*, were found fitted in a secondary degree, being only partially destroyed in winter. But the whole of the Ryegrasses, most of the Fescues, and the other commonly cultivated sorts, were so much injured in winter as to require to be resown in spring.

[At the General Meeting of the Society in July 1835, it was announced that the Duke of Buccleuch had caused an Agricultural Garden to be formed in Dalkeith Park, for the express purpose of experimenting in various methods on the cultivation of the plants used or which might be used in agriculture. The foregoing Report exhibits the results of the first year's experiments. It is to be hoped that his Grace will cause the results of every succeeding season to be made public.]

[A piece of Plate of the value of Thirty Sovereigns was awarded to Mr Landale for this Mineralogical Report of the Coal Field in the south-east of Fife.]

REPORT ON THE GEOLOGY OF THE EAST OF FIFE COAL-FIELD,
WITH MAP AND SECTIONS. *By MR DAVID LANDALE,*
Coal-Engineer, Wemyss, Fifeshire.

Preliminary Remarks.—THE unexpected success which my paper, * on a portion of the Fife coal-field, met with last year, has induced me to explore farther into the subject : and while collecting data for this purpose, I found that the subject would be much more complete, and more easily understood, by shewing the other rocks, and exhibiting their connexion with the coal strata.

In the attempt to accomplish this, I am fully sensible that my proficiency in the science of geology is not so perfect, as to enable me to do the subject any thing like justice. I trust, therefore, that the more advanced students of the science, will be indulgent to me when they occasionally find a slip ; whilst I promise, that what I do describe, shall not be speculative, but will either have come under my own observation, or have been proved by mining operations. My profession throws me in the way of seeing some of the most interesting phenomena of geology ; and as the particular subject of coal-fields has been seldom written upon by practical men, I would fain hope that the present paper will possess no inconsiderable interest, both in a geological and statistical point of view. In order to render the description as clear as possible, I have avoided statistical detail as much as I could, in describing the map and sections. In describing the trap-rocks, I have confined myself to the effects they produce on other rocks, more than to a mineralogical description of them, as that is the point in which I am most deficient. The map will be easily understood by the references attached to it. I have

* See vol. x. p. 411.

introduced several quarries by particular marks. These are not intended by any means to show the number of quarries in the district; I have only inserted them where they happened to be near the outline of either sandstone or trap. They are of the nature of vouchers to shew the kind of rock at that spot, when I had no other means of discovering the exact point at which the rocks met. Considerable difficulty attends this part of the subject; for where there is no rivulet or quarry at the point of junction, I have been obliged to infer that point, either from the outline, or from the soil. Upon large overlying masses of trap, it is also probable that detached pieces of sandstone may be covered with soil; and should an error of this kind occasionally occur, the reader will understand the cause of it. What is coloured, however, may be depended upon, in every case, as being as correct as could be ascertained from an outward inspection. The part coloured red, with black lines of coal, must not be understood as being entirely sandstone; it is composed of the usual alternations of the coal formation,—a good idea of which may be gathered from the written sections of strata, published in my last paper, and what will appear in this. I attempted to introduce beds of shale, &c., and to subdivide the trap-rocks with separate colours, but found, that on so small a scale,* it would have confused the map. Sandstone, therefore, being the prevailing rock, that colour has been ~~used~~ only. In the sections, however, where the beds of shale are thick, I have coloured them; but the reader must not expect that every thin bed is represented. To those who wish a detailed view of this, I must refer them to the sections at pages 277, 288, 293, 304, 318, and 327, and to last year's paper from page 12th to 19th. The limestones are coloured green, and to make them conspicuous, a broader piece of colouring is introduced. This sometimes covers a coal, but the position of such is denoted by the black line, while that of the limestone is shewn by the dark green line. In this map every thing that is not con-

* The scale of the drawings has been preserved in the engravings.—*Ed.*

firmed by actual observation, is put down in dotted lines, so that all the supposed can readily be separated from what has been really seen and known.

In my survey of last year, the structure of the country was comparatively simple. I approached the very verge of the trap-rocks, and then shrunk from the task of describing them, after having had a good many facts collected. I have since gone on perseveringly, and have succeeded in understanding a district which is as complicated as can well be imagined; the many eruptions of trap having torn and rent the sedimentary strata into every conceivable variety of contortion and disturbance. The facts which will be brought out in this part of the investigation, are of high interest to the geologist: however, they are objects of geological curiosity only, and are of no interest in a statistical point of view, except that they have destroyed large portions of an extensive coal district. I have found it necessary to add the map of last year to what I have done in this, as it would have been impossible to have understood the form of the coal-field without it; and there are some additions and trifling alterations upon it, besides being coloured.

Alterations in and Additions to the Map of Last Year.—There is a broad piece of trap tuffa passing from the Kirkcaldy trap-dyke, down through the town, as seen on the map. It is not an overlying mass, but seems to have been forced in among the coal strata which are altered and indurated at the points of contact. The indurated shale and confused hard blackish slate-clay, mentioned last year, must have been in contact with this tuffa. Some wells have been sunk in this substance, which yield very little water. It is very compact when first wrought, but on being exposed to the atmosphere for a few days it crumbles down to a greenish-black powder. There is also a bed of greenstone about ten feet thick, situated between the Inverriel coal and coal No. 28. (See margin of Map). It occurs on the beach at Tyne Bleachfield, and is very remarkable for its conformity with the sedimentary

rocks. It appears regularly interstratified amongst them, and holds its place a considerable distance to seaward, forming one of the shelving rocks inside the well known "Bow Rocks," opposite Seafeld. It lies between a bed of sandstone and shale; the lower part of the greenstone gradually passing into indurated shale, the point of junction not being well defined. Between the real trap, however, and the *unaltered shale*, the substance is more like wacke than any thing else. Under the shale, which is about three feet thick, there is a two feet bed of sandstone; then eight feet of shale, with thin bands of slate-clay and ironstone. In this bed there is an irregular vein of wacke passing across it and the sandstone, connecting itself with the greenstone. Under this, there is a two feet bed of coarse limestone, covering a six inch band of cherry coal; under which, there is a series of alternating beds of sandstone, slate-clays, shale, and two feet of white limestone, exhibiting some curious overlappings; then shale on the Innertiel coal (No. 29); under which lie the thicker beds of the carboniferous limestone. In my last Report, it was stated that the Dunnikier seams did not proceed to the south of the Kirkcaldy trap-dyke. I have since ascertained that they have been wrought on the beach at Kirkcaldy, and for a considerable distance seaward. The lines of the coals are now extended on the map, in the direction they were wrought, and are connected to the table by dotted lines at right angles from them. This, it is hoped, will be found an improvement, as I found that the circular dotted lines were taken for the supposed line of bearing by superficial observers, who did not consult the letter-press. The Dunnikier seams of coal were also said to streak north to Orr Water. This, I have reason to believe, is not correct; for it is certain that they were wrought at Cluny, a distance of two miles to the north-westward. It is, therefore, more probable that they bear in that direction. This supposition is strengthened by their distance from the carboniferous limestone wrought at Chapel, which is just about as far from the coals at Cluny, as the

Dunnikier seams are from the same limestone at Innertiel. The next alteration is an extension of the Tyllibreak coals. These seams have been discovered since last year, training northward in a semicircular form, and dipping west. (See Map.) It has always been supposed that these two coals, with their concomitant strata, are the Dysart coals, from their perfect similarity, and various hypotheses have been suggested to account for their appearance here. I mentioned that it was generally believed, that they were thrown up by a fault, or series of faults, and that no sight of any thing of the kind could be got at.

It would now seem from their dipping west, and the Dysart ones dipping east, that they form a trough or basin; but farther exploration will be necessary before this point can be positively determined.

After tracing the Dysart and Wemyss coals through a considerable distance of country, and describing the various large faults met with, I stopt at two points where it was supposed the seams of coal were interrupted by a trap-dyke, and it is from these points that the present survey commences. No drawn sections were given last year, and I have not supplied them now, as the subject was so simple that it could be understood without them. The reader is referred to last year's paper, for all details south of this trap-dyke; and this was one reason for the original figures and letters of reference being retained, although they do not accord with the plan I have now adopted.

Method of conducting the Survey.—Having procured the best map of the county that could be got, I took a copy with a pentagraph, upon a large scale, and in the fullest detail, for the purpose of jotting down and colouring every particular after returning from my journeys. The copy accompanying this, for the sake of distinctness, was divested of much of topographical detail, retaining only as much as would shew the localities of the various rocks, coals, and faults met with.

I had the engraved map cut down into convenient pocket sizes for taking into the field; I first visited the collieries and obtained all the information I could from their managers, at the same time carefully noting every thing that came under my own observation. Where no plans or sketches existed, I took the positions of the rocks, coals, &c. in the following manner:—Having placed myself upon the spot, I took bearings from three of the most prominent objects the locality afforded, taking care that the distance between each object formed fully a right angle: these three bearings were then laid down on the map, and the point of intersection taken as the position of the rock in question. I also had recourse to the following method of determining the position of rocks, &c. —Suppose, for instance, that, on examining the bed of a brook, I wished to ascertain the position of a coal, I climbed to the bank and looked about me for any two prominent objects that happened to be in a straight line with the point where I stood. Having noted this carefully in my survey book, I afterwards extended the line on the map across the two objects until it bisected the brook. I found this method sufficiently accurate for geological purposes, and where it can be adopted, it is a great saving of time. After having obtained all the information I could about the collieries, I wrote to the proprietors asking them to allow me to examine any papers they might have relating to the minerals under their estates. I have been fortunate in getting mostly all the records of former mining operations, and where I could not get these, I found out old men who had wrought, or whose fathers had wrought, the coals, and having examined the ground in company with them, I often formed a pretty correct idea of the district. Upon one occasion, I had the satisfaction of proving the correctness of this method. I explored the Kellie coals (section 7th Plate IX.) in the above manner, and laid them down on the map; some time afterwards, a large bundle of papers and reports were sent to me, which described them through most

of their course. Upon comparing these with what I had previously done, I found there was nothing to correct, and more information had been elicited about faults and dykes than the proprietors themselves were possessed of. I cannot quit this part of the subject without tendering my warmest thanks to those gentlemen who, on my application, were so obliging as to furnish me with all the information they possessed. After obtaining this insight, I minutely explored the sea coast from Drumochy to Pittenweem, and afterwards made journeys into all parts of the country within the bounds of my survey, examining the rocks, &c. In these excursions, I was fortunate in securing the services of an assistant who was at one time employed as a borer for coal, and who thus had an extensive local acquaintance with most of the mining districts in the east of Fife, and consequently was very serviceable to me in this part of the inquiry.

Classification of Rocks. On this subject I think it unnecessary to say much, as the district under survey is entirely composed of the following well known rocks and their varieties; sandstone, shale, slate-clay, bituminous shale, bituminous slate, argillaceous ironstone, limestone, coal, and the trap-rocks, and fortunately there is now little or no difference of opinion among geologists as to the origin of these rocks.

Topography. I can bear testimony to the correctness of the map of the county of Fife, published by Messrs Sharp, Greenwood, and Fowler, and made on the basis of the Government Trigonometrical Survey of Scotland. I have measured and surveyed several parts of it, and have found it remarkably correct. There are a few omissions, the most of which are buildings that have been erected since the map was made. The only thing at all wrong with it, is, that a few of the places are not named correctly. The names substituted, however, have always a similitude to the right one; thus, upon inquiring for "Cellar Hole," the people of the place had never heard of it, when, upon further inquiry, the real

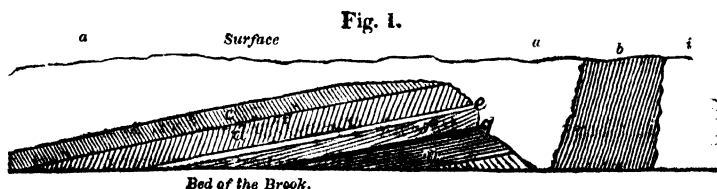
name was found to be "Silver Hall." It has often occurred to me, that it would be an excellent opportunity for executing geological surveys, were a geologist or two to accompany the officers who conduct the trigonometrical surveys. The ground has often to be gone over at any rate, and they would have more time, better instruments, and abler assistants, than a private individual can usually command.

Relations subsisting between the Rocks and Soils.—Upon this subject I am not at all qualified to give a correct opinion ; but as the Highland Society expressly calls for information on this head, I shall mention generally, that I have observed the best crops on the gently sloping sides of trap hills. But this is not invariably the case. Where the trap is of a very ferruginous character, it decomposes into a rusty brown soil, which extends to a considerable depth. Such land is usually sterile, damp, and unproductive. When the trap, however, is of the compact basaltic or greenstone character, there is not such a depth of soil. The crops raised are excellent, and the interstices between the columns or vertical beds act like so many natural drains, and carry off the water. The highest rented land in the county appears to be on tuffaceous slopes, the soil black and light, and seems to have resulted from the disintegration of the tuffa, afterwards mixed with vegetable mould. The lands resting on the coal formation are very various. The elevated flat districts have usually little soil over the rocks, and the crops of coals are often found in draining, (this the farmers very often conceal, for there is nothing they dislike so much as coal-pits in their fields). These elevated portions are commonly good land ; but the eastern declivities and low grounds are covered to a considerable depth with strong tenacious diluvial clay, sometimes extending to sixty feet in depth. This requires close and perfect draining to make it yield good crops ; and much of it continues to be poor land, although all the modern improvements are put in requisition on it. These diluvial clays, always occupying the eastern

slopes of elevated ridges, are very instructive, and clearly point out the action of a great current of water having at one time flowed from west to east. The clays are of the blackish yellow kind, and seem to have been detached from the shale of the adjoining coal strata. The arenaceous rocks having been worn and comminuted into small sand, had been carried off to a distance by the current ; while the heavy argillaceous matter, after being undermined, had half floated in masses, and fallen into the first protected spot they had passed over. These clays contain water-worn stones from the size of the hand to that of boulders two tons in weight, some of which must have been rolled from a great distance, as they are composed of granite, gneiss, mica-slate, and many other of the primitive rocks, which are not to be found in situ for many miles. By far the greater portion, however, of the stones and boulders imbedded in the diluvial clays, are of the harder varieties of the trap-rocks, such as basalt, greenstone, and porphyry, derived from the neighbouring trap hills. These are often arranged in causeways, like the scales of a fish, or the stones in the bottom of a brook, in a depth of 24 feet. I have met with three distinct causeways of this kind. The proportion of sandstones is very small, and this can only be accounted for by the fact, that they cannot resist the action of running water so well as the trap and argillaceous rocks, consequently they would seldom be detached in masses ; and, when this did happen, a few miles scouring along among the harder debris would soon reduce them. Organic remains are not plentiful in this diluvium. I have only met with one or two *fossil* shells.

I. 1. *Course of the Athernie Trap-Dyke.*—Sect. I, Pl. VI. —The trap-dyke H, from which this survey commences, is first seen on the sea-beach at Drumochy, about six hundred yards west from Largo. It has rather an irregular appearance, and does not seem to go far to seaward. On the west side of it, there

is a vertical vein of dark bluish basalt, passing into clinkstone; and to the east of this, there is a confused assemblage of claystone, porphyry, basalt, and altered sandstone, upon which the shale and "tar coal" A rest, contorted and turned up almost upon edge, as represented on section 1st. The altered sandstone among the ruins, produced by the dyke, has a very striking appearance. Some of it has a flinty aspect, approaching to quartz-rock; other pieces are conglomerates of sandstone, coal, ironstone, and slate-clay. Some specks of the coal are coked, others are glistening, and apparently little altered. All these materials are distinctly observable in a hand specimen now before me. The next point at which it has been seen, is about one and a half miles to the north-west, where it was known to interrupt the continuity of the three seams of coal, seen on the map. No distinct records of its appearance, however, are extant. An old miner assured me, that before the coal-workings approached that point, the coal got so coarse, and so full of small slips and faults, that it was not worth the working. This was the case on both sides of it, and I have never heard that the trap was approached at all. Yet the evidence is conclusive, that an extensive dyke passes this point. It cannot be ascertained whether the strata is shifted or not. A view of this dyke is next obtained where it crosses the stream at Athernie Den, where the basalt is of the same kind as that at Drumochy. A little to the south of the dyke, a section, something like the accompanying diagram, is exposed:



a a Alluvium and decomposed trap; *b* basalt; *c* wacke; *d* earthy greenstone; *e* indurated shale; *f* shistose] sand-

stone and shale much altered; *g* slaty coal, 8 inches; *h* sandstone; *i* sandstone and shale, very confused. The space at *a* is covered with soil, and hides the connexion of these alterations with the basalt of the dyke.

The next point at which this dyke is observed, is in Kennoway Den. It is here a protruded mass of trap-tuffa, with patches of wacke and detached balls of indurated sandstone, intimately mixed with pyrites and sparkling scales of mica. The tuffa is interlaced with veins of calcareous spar, and some of compact felspar. The strata on both sides of it are considerably altered and deranged, but for a few yards only. Proceeding in a westerly direction, we find that the same dyke put a stop to the mining operations in the Balgonie coals, at the point D, noted last year. It was described to me in the following terms, by an old man who remembered having seen it. "The coal was flung up with many small hitches, like steps and stairs. It was very difficult to work, and at last was cut off altogether by a ratchell* dyke." The last point at which it has been seen is on the south of the Balbirnie Coal Basin at I, where it is thirty feet thick of hard basalt. No coal has been found to the south of it, although a bore was put down to the depth of 100 yards; in which nothing was found but clay, sand, and gravel. Between this point and D in a quarry at Lythrum Mill, I observed a large fault throwing up considerably to the north. There is much confusion among the strata adjoining this place. About 200 yards farther north, in a quarry, there is much distortion visible. The rocks incline at a very high angle, and do not dip in the usual way. It will be observed, that I have drawn the dyke in by this point (Lythrum Quarry); but it must be kept in mind, that there is no trap visible here.

This extensive dyke is the first trap that is known in all the triangular rising ground between Kirkcaldy, Drumochy,

* Ratchell, a miner's provincial term for all sorts of trap which may be softer than whinstone

and Auchmuty ; and it is remarkable, that its course is about equidistant from the main body of the igneous rocks which occupy the high grounds. It appears to me, that the great change of level which has taken place between this dyke and Wemyss (amounting to 304 yards, see section 5th Plate IX.) has been produced by extensive convulsions, occasioned by the trap when in a state of fusion, either by water being admitted and steam of a high degree of elasticity formed, or that gas has been evolved, which has exerted an amazing force, and raised the country from its former level ; that at each successive heave of the strata, the steam or gas had found vent by the new made fissures, the liquid trap flowing in to supply its place and supporting the upraised mass on the one side, while the change of position of the fused matter had allowed the other side to subside ; that another and another such earthquake happened, until the igneous rocks approached so near the surface, that at the next heave the fractures were filled with incandescent basalt, producing our present trap-dykes. That at the next and last upheaving, the trap burst with volcanic violence, and overflowed the country, as represented on the map. Abundant evidence will appear, as we proceed, of such volcanic vents ; and, indeed, it would be impossible to explain how many of the coals have assumed the present position, without admitting volcanic agency. The very many instances which have taken place, within the period of history, of portions of continents being upraised, and violently shaken by earthquakes, which never rested until the disturbing cause found vent at a volcano, warrant us to conclude that such mighty convulsions produced these faults, and once shattered and dislocated the county of Fife.

2. *Description of the Coast from Drumochy to Pittenweem, along the line of Section 1st, Plate VI.*—From the trap-dyke at Drumochy, I shall now endeavour to conduct the reader along the sea coast. Resting upon the trap of the dyke, we

find altered sandstone and shale turned up upon edge, and twisted into waving lines. The "tar coal" A (so called from its bituminous nature) is included in the vertical strata. The following section occurs, measuring along the rocks on the line of section 1st. The thicknesses of the coals, however, are given at right angles to the planes of their beds, while the other rocks are measured along the horizontal surface of their out-crops.

Ascending Section of Strata connected with the Drumochy Coals.		Yds.	Ft.	In.
A	Tar Coal,	0	1	10
1	Shale,	33	1	0
B	Three Feet Coal,	0	3	0
2	Yellow Sandstone,	46	2	0
3	Shale with Shistose Sandstone,	26	0	0
C	Black Splint Coal,	0	1	6
4	Red Sandstone,	3	1	0
5	Shale with Bands and Balls of Ironstone and Slate-clay,	16	2	0
6	Fire-clay, with Ironstone Balls,	7	1	0
D	Coal,	0	2	0
7	Shale and thin Bands of Ironstone,	8	1	0
E	Coal,	0	1	8
8	Shale, Slate-clay and eight bands of Ironstone, from 1 to 2½ inches thick,	8	0	0
F	Coal,	0	1	6
9	Shale, Slate-clay, and Nodules of Ironstone,	10	2	0
G	Coal,	0	5	0
10	Alternations of Shale, Slate-clay, and Shistose Sandstone, with some Bands of Iron,	5	2	0

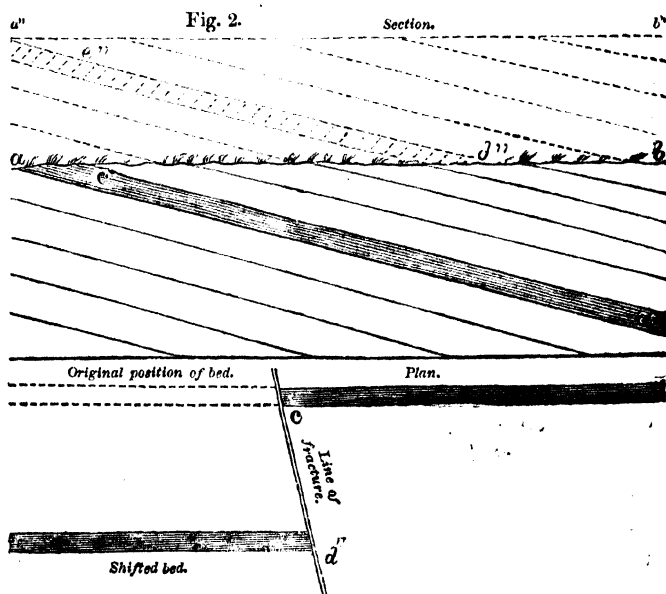
Ascending Section of Strata connected with the Drumochy Coals.				Yds.	Ft.	In.
11	Sandstone and Shale in thin beds,	.	.	8	0	0
H	Coal,	.	.	0	1	0
12	Shale,	.	.	0	1	0
13	Sandstone,	.	.	16	2	0
14	Yellow Sandstone,	.	.	42	0	0
15	Open textured Quartzose Sandstone,	.	.	18	2	0
16	Sandstone,	.	.	9	1	0
17	Shale and Slate-clay of a pink colour, with beds of Shistose Sandstone,	.	.	30	0	0
18	Ochre-yellow,	.	.	1	0	6
19	Shale of a porphyritic structure, red and white spots,	.	.	83	1	0
20	Shale of a lake red colour,	.	.	43	1	0
21	Hard red Quartzose Sandstone, being the protecting ridge of Largo Pier,	.	.	28	0	0
22	Grey Sandstone,	.	.	5	2	0
23	Yellow Sandstone,	.	.	33	1	0
24	Alternations of coloured Shale, Slate-clay, Bituminous Shale, and Sandstone in thin beds, and flattened Ironstone Septaria,	.	.	50	0	0
25	Hard brown Sandstone,	.	.	10	1	0
26	Shale, Slate-clay, and Ironstone balls,	.	.	16	2	0
27	Black Bituminous Shale,	.	.	2	0	0
28	Variegated Shale, with amygdaloidal pink and white spots,	.	.	16	2	0
29	Slate-clay,	.	.	10	0	0
30	Shale,	.	.	16	1	0
31	Compact dark red Sandstone, with spots of greenish coloured Shale,	.	.	16	2	0
32	Reddish Shale, with some Shistose Sandstone,	.	.	78	1	0
33	Soft red Sandstone,	.	.	50	0	0
34	Porphyritic red and white Sandstone,	.	.	183	0	0
35	Dark red Sandstone,	.	.	45	0	0

At this point fault No 1 (see map and sec. 1st) occurs, by which the strata is thrown up about seventy yards. The line of section now passes over 500 feet of unstratified red sandstone, having veins in it running parallel to fault No. 1. No. 2 dyke is then met with, which lifts up to the surface the piece of strata containing the Drumochy coals, and this

upraised piece of strata, represented in a horizontal position in the section, dips north; and a little inland four of the Drumochy seams of coal have been wrought, and are here designated the "Strathearly coals," from their lying on a property of that name. Their line of bearing is about east and west for 1300 yards, when they turn round to the north, and extend for about 400 yards in a semicircular manner, and dip west. This curvature lies under a thick bed of trap-tuffa, and towards the northern extremity of the coal it passes into greenstone porphyry. Since I surveyed that quarter, a pit has been sunk to the coals, but they are of very inferior quality, and, I understand, are not worth the working. The old sketches notice a dyke or fault near Strathearly Burn, but no mention is made of the shift up or down; it is probably a prolongation of fault No. 3. The Drumochy coals, from where they are first seen on the beach, bear inland in a north-easterly direction, until they are thrown up about seventy yards, by fault No. 1. Beyond this, only four of the seams have been found. They have been wrought, and are here called the Lundin Mill Seams; they bear north-east, exhibiting some curves in their course, and are supposed to extend under the overlying basalt, until they are destroyed by the eruption of Largo Law. These Drumochy coals, I am certain, are the same as the first seams of the coal-field seen at Wemyss Castle, and mentioned in my report of last year, but thrown forward by the faults E, F, G, H, (map.) I am the more convinced of this, not only from their similarity and relative position, but from the circumstance, that the peculiar bed of ochre, with its roof of porphyritic and quartzose sandstone, overlies them. These strata are observable at equal distances (or nearly so) from the coals,—first, at Wemyss Castle, then at Buckhaven. The ochre is next seen and wrought a little north from Methill, after being thrown forward by the fault E. It is then wrought north from the town of Leven, after being thrown forward by the fault F; and lastly, it is seen above the coals at Drumochy. This

peculiar substance, so extensively used as a pigment, has not, to my knowledge, been analyzed. It appears to be a very fine clay or shale, coloured bright yellow by oxide of iron. It is a most variable substance; sometimes it diminishes in thickness to three or four inches, and then swells out again to as many feet. It is very difficult to be got free of sand, which renders it nearly useless. At Wemyss Castle it is not sufficiently coloured for use; at Buckhaven it approaches to the nature of sandstone; at Methil it is sometimes pure, and a few yards farther is impregnated with sand; to the north of Leven it is even more irregular; and at Drumochy it is quite arenaceous and useless.

Before we proceed farther, it may be as well to explain how it happens that faults always shift the crops of strata to one side; how, for instance, the same strata are seen at Wemyss Castle, and then again at Drumochy, while the line of bearing would have carried them (if uninterrupted) nearly two miles inland. The following figure 2. will, it is hoped, illustrate



this point. Let ab (section) represent the surface of the earth, and cd a bed of coal, inclined at an angle of one in five. Now, if the bed of coal strata and earth be lifted up to $a''b''$, we have a line of fracture visible; the one mass of strata lifted distinctly above the other, and represented by dotted lines, and the same letters of reference with inverted commas; in this case the shift is easily seen. But suppose the raised terrace $a''b''$ worn down to the original level ab , we would then find the crop of the coal cd at the point d'' , as seen on both plan and section of the figure. Now, we have only to measure the distance from c to d'' (plan), and divide by five the angle of inclination, and we have the height of the throw. Now a series of faults has occurred between Wemyss and Drumochy, which has brought the strata forward in the same way for nearly two miles; had I not known of these faults, I would not have believed this to have been the same strata. A minute attention to faults and dykes is absolutely necessary to obtain a correct view of the structure of a country. Suppose, for instance, that a geologist were to examine the rocks on the sea-coast from Wemyss to Drumochy—where a great sameness of mineral character prevails—and not observe the faults, he would be very apt to conclude, from the dip and line of bearing, that he had passed over a bed of immense thickness, whereas, in fact, he had passed over the same bed three times. Hence it is, that our best geological surveys are but rude approximations to the real state of the interior of the surface. The fault which I have thus attempted to describe the effect of, is of the simplest form. Faults occur in many other and very complex shapes. The line of them is not always straight, being often ragged, waving, and uneven, with shoots passing off from them at all angles. The lines upon this map are mostly straight, and only point out their general direction. There are also many minor faults and slips, too minute for representation on so small a scale, and are therefore excluded, to prevent confusion on the map. This

digression having occupied too much space already, I shall resume my description at fault No. 3, (map and section 1st). This dyke or fracture seems to have been the place at which the mass of strata containing the Strathearnly coals has been broken, but I have no means of correctly ascertaining the fact. Immediately east of this, along the line of section, we pass over an overlying mass of vesicular earthy greenstone. Sometimes it passes into tuffa, and contains imbedded lumps of basalt, large granular greenstone, and limestone of a very crystalline texture. This bed is nearly a mile broad, and is proved to be an overlying mass by the mining operations at Strathearnly. It must have flowed down from Largo Law, but will be mentioned more particularly when describing that hill. Along the coast, the rocks are covered with sand for fully a mile, and although I have often gone at low stream tides, I could never get a sight of them. They must be sandstone, however, from those we see inland. We now come to the promontory of Shooter's Point, which is not more than 200 yards broad, and projects into the sea for nearly half a mile. It is composed of black compact basalt, disposed in rude columns. There is also some greenstone porphyry. These two rocks occupy various places of the promontory, and are surrounded by trap-tuffa, interlaced with a good number of veins of calcareous spar, which separate into small rhomboids. On the very centre of the point, there is a small basaltic cone, represented on the section. I suppose the whole to be an overlying mass, but I have no distinct evidence to offer on the point. Proceeding round the little bay from Shooter's Point towards Kincaig Hill, there are no rocks seen; but from the extent of excavation made by the sea, I should think it must be either sandstone and shale, or soft tuffa. The western slope of Kincaig Hill is composed of black trap-tuffa, until we come to the patch of sandstone and shale at B, which dips west, and bears as indicated by the faint red lines on the map. Where it is in contact with the trap, it is distorted and indu-

rated; some of it remarkably like quartz-rock. Passing the face of Kinraig Hill, (a rough sketch of which is represented, although not in the line of section), we find it composed of tuff-basalt, greenstone, and amygdaloid. The tuffa is interlaced with innumerable veins of calcareous spar, and some parts of it being harder than others, these stand up in sharp triangular spires, which resist the action of the sea, while the softer parts are excavated into deep and picturesque gullies and caves. The tuffa contains imbedded lumps of altered and striped red sandstone, basalt, porphyry, amygdaloid, and greenstone. The sketch on the section will shew where it is occupied with basalt. The upright mass observed about the centre of the rock is a combination of most beautiful small basaltic columns of very regular forms. They are five-sided, and are aggregated into larger columns of about three feet in diameter; in one of these I counted twenty-four of the smaller. The lines of junction, as also the transverse joints, are concave and convex, and fit very nicely into one another. The points of junction are vesicular and porous for half an inch at the surface, exhibiting exactly the same appearance that cast-iron does when poured into a mould that is too damp. One of the large columns has been undermined, and has fallen on the beach. It is broken into masses four or five feet long, and rounded by attrition; yet so firmly are the smaller columns joined, that the mass appears solid, and the pentagonal lines can be distinctly traced upon the rounded boulder. The stratified part of the hill *c c c c* is composed of porphyritic amygdaloid, very easily decomposed by the weather. This rock is altogether highly interesting, both to the geologist and mineralogist. Although at the part which the line of section passes it is overlying, yet a little farther to the north, it is proved to have been ejected, by the mining operations of the adjoining colliery. It has once been a ridge, with both sides sloping gently towards its base, and the action of the sea in the course of ages has gradually undermined and denuded

the tuffa of the south slope, until the present mural cliff has been presented to our view. From Kincaig rock, the tuffa sweeps round about low water mark, and joins the solid basalt of Earlsferry Point. The clumps of columnar basalt here are also very beautiful, and much resemble those of Kincaig. The links between Earlsferry Point and Kincaig Hill are occupied by a portion of the Earlsferry coals, noted on the margin of the map. Trap-dyke No. 4 (map) is composed of wacke, and is first seen on the beach at the foot of Kincaig rock, where it presents some curious appearances. Overflows of wacke and strange mixtures of all the members of the coal formation, ironstone, sandstone, shale, coal, and trap-tuffa, are observable within a few feet, all altered,—the ironstone calcined, the shale burnt into a substance something like fire brick, and the sandstone mixed up with particles of half burned coals. Small lateral shoots are also seen passing out from the body of the dyke, which is next seen in the coal workings in the links, where it was known to throw coals down to the north sixty-four yards, and to alter the line of bearing, which is a very common occurrence with trap-dykes, while it seldom happens at a common fault. The reason of it seems to be, that the strata on each side have been raised into a flat conical shape, and afterwards abraded by diluvial action, when the crops of the strata are seen out of the straight line as much as the cone-shaped piece was raised. Dyke No. 4 is next seen above ground, passing across Earlsferry Bay. Section 6th, Pl. IX, exhibits the effect that this dyke (of wacke) produces upon two of the seams of coal. Upon the south end of this section the coals were found turned up nearly upon edge, and very much destroyed by the basalt. This was fully proved by the lessee of the colliery, who put down a bore here, and found twenty feet of coal! Preparations were immediately made for sinking; but when they got down, the coal was only found to be eight feet thick, when measured at right angles to the plane of its bed, the bore having passed perpendicularly through the high-

ly inclined portion deranged by the ejection of the basalt. After passing the sixty-four yard dyke, these coals are again tossed up, and cut off by the trap of Kincaig Hill. Before they approached it, they met with the small slips or faults *a b c* (section 6th), each of which lifted the coal fully three feet, the coal got foul and blind,* and at last was quite upon edge, when it was abandoned. These facts have not come under my own observation, but the manager of the colliery assured me of them; and I have since examined two of the most intelligent of the miners, whose accounts corroborated the first statement.

Kincaig rock does not extend farther to the eastward than the house of Grange, from the back of which, however, a trap-dyke, No. 5 (map), has been found to interrupt the coal. This has been met with since I examined the spot, but no discovery has yet been made as to whether it throws the coals up or down. There can be no doubt, however, but they will be found beyond this. When I was in this district, I noted a piece of basalt looking through the ground a little to the north of Elie, which I suppose to be a continuation of trap-dyke No. 5, and have therefore drawn it in this position. There is another trap-dyke, No. 6 (map), which passes from Earlsferry Point, across the bay to Harbour Point. I have not ascertained how much this dyke shifts the strata, as the sea covers it, except at very low tides; and no mines have been wrought so far seaward as to determine the point. There can be little doubt, I think, but that these seventeen seams of coal proceed to seaward.

The Earlsferry coals are the first on the east side of the great east of Fife coal-basin; they dip west at an angle averaging about 12° . It will be observed by section 1st, P. VI, that the last rocks dipping east were at Largo, consequently

* Blind coal is a term used for coal that has been deprived of its bitumen, or imperfectly charred. It burns with little or no flame, and occurs frequently in Fife, either in contact with, or near the trap-rocks.

the centre of the basin must be somewhere between Johnston's Mill and Shooter's Point. Proceeding eastward we find a large protruded mass of trap, of an irregular form, occupying the ground from St Monance church to Elie ness and Harbour Point. The greater part of this is trap-tuffa, containing patches and imbedded masses of almost all the other trap-rocks, with sandstone and limestone. It also contains rubies. I saw one about the size of a coriander seed. All the rocks of that neighbourhood contain this mineral, and it is a favourite occupation of the sea-bathers to riddle and examine the decomposed trap-tuffa in search of them. The one I saw was in the possession of a lady I found thus employed. The tuffa is of a greyish-green, and sometimes of a blacker shade. It decomposes easily at some places, while at others it resists both the action of the sea and atmosphere. A remarkable instance of the protection which these rocks afford to the coast is seen at Elie Bay, where the conical clumps of basalt at Earlsferry Point, and the solid tuffa of Harbour Point, jut prominently forward into the sea, like protecting bastions, which have resisted the heavy surge that has rolled in here from the German Ocean for ages; while the softer sedimentary rocks of Elie Bay have been scooped out into their present semicircular form. The line of section now crosses Harbour Point, and in the little bay of Woodhaven vertical strata of sandstone and shale are seen, with a bed of limestone, B, (sect. 1st and map), eight feet thick, of a dark bluish colour, and very compact. This limestone appears to be the same as that at Balbuthie, and it is wrought inland at A. It is eleven feet thick here, and bears and dips as seen on the map. It is of a bluish-grey colour, and contains encrinites, but not abundantly, and other shells are very rare. It is divided into three beds of different qualities. About half a mile farther east, a coal of three feet six inches thick has been wrought, which bears and dips as shewn on the map. The cause of these dips and bearings will be better understood after reading the description

of the trap-rocks between this point and the shore. Beyond limestone B, on the beach, the strata dip east as shewn in section 1st. Passing over Elieness, we again meet with strata of sandstone, shale, and slate-clay, with some thin bands of ironstone, dipping east and forming a portion of a basin, represented on the section, and by the faint red lines on the map. The dyke of wacke, No. 7, (map) passes out to seaward here. I will not attempt minutely to describe the coast from this point to St Monance. It consists of a heap of ruins; confused and vertical strata, mixed up with wacke, tuffa, altered rocks, detached pieces of coal and limestone, and three projecting pieces of trap, in one of which the basalt dyke No. 8 (section 1st and map) appears. It consists of dark coloured basalt, with crystals of augite. It is two feet thick, and tapered towards the top resembling a mason's dyke. It is quite vertical, and stands six feet above the tuffa, although constantly exposed to the action of the sea. On each side of it there are crusts of calcareous spar, and numerous veins of the same material run parallel to the dyke, at some distance from it. The map and section will give a better idea of the coast than a written description, only it must be kept in mind that I have found it impossible to represent the confusion as it really is. The section and map, while they give a general idea of it, are much more regular than the rocks themselves. A little to the east of Newark Castle, a bed of compact blue limestone E, (section 1st and map) about three feet thick, frequently appears among the vertical strata; and a little farther east a large trap-dyke, No. 9, (map) passes to seaward in the direction of the Island of May. It is composed of compact bluish-black basalt, occasionally passing into clinkstone, and stands high up in the sea. We now approach the extraordinary basins of St Monance and Pittenweem, to understand which the reader must carefully consult the map, and sections 1st and 2d Plate VI. where I have retained all the local names for reference. Resting upon the trap of St Monance church, the following section of strata is found. I have given the details of it, as we will often have occasion to notice them.

The thickness of the limestones and coals is measured at right angles to the plane of their beds, while the other rocks are measured along the line of section as they occur on the shore.

Section of Strata connected with the St Monance and Pittenweem Basins.

	LIMESTONE.	COAL.	ROCKS.
	Ft. In.	Ft. In.	Yds. Ft.
1. Sandstone, with some beds of shale, resting upon the trap of St Monance church, . . .	...	...	50 0
2. D. The " <i>Suttie Limestone</i> ," compact, of a dark bluish-grey colour, few organic remains, .	10 0	...	...
3. Shale, with bands of ironstone, from two to four inches thick, . . . . .	...	...	6 2
4. Shistose sandstone, with partings of slate-clay, . . . . .	...	...	6 1
5. Slate-clay, with nodules of ironstone, . . . . .	...	...	6 2
6. E. The " <i>White Limestone</i> ," containing encrinites and marine shells, of a whitish-grey colour, and compact texture, . . .	16 0	...	...
7. Shale, with alternations of shistose sandstone, and inch bands of ironstone, . . . . .	...	...	20 0
8. "White lime coal," . . . . .	...	2 0	...
9. Shale, . . . . .	...	...	0 2
10. B. " <i>Abercrombie Limestone</i> ,"	2 6	...	...
11. Alternations of shale, slate-clay and sandstone, with irregular masses of ironstone, with terebratula, . . . . .	...	...	9 1
12. " <i>Abercrombie coal</i>," . . . . .	...	4 0	...
13. Alternations of slate-clay, black bituminous shale, and sandstone, . . . . .	...	...	6 2
14. A " <i>Pilkembare Limestone</i> ," compact, grey colour, no organic remains seen,	6 0	...	...
15. Shale, slate-clay, bands of ironstone, and thin films of sandstone, . . . . .	...	...	60 2
16. " <i>Little Limestone</i> ,"	2 10	...	...
17. Regular alternations of shale and sandstone in thin beds, with some ironstone bands, . . . . .	...	...	61 2
18. Sandstone, with slate-clay partings, . . . . .	...	...	46 2
19. Shale, . . . . .	...	...	1 1
20. "Harbour coal," . . . . .	...	6 0	...
	37 4	12 0	

This mass of strata is now bent like the section into a basin form, the "Harbour coal" forming a little trough, which is the fairway into St Monance harbour. The pier is built on the east crop of the trough, and about 130 yards farther east the sandstone forms a centre, and in the space of a few feet dips rapidly west, south, and east, as shewn by the small arrows on the map. After this the line of section passes across the four St Monance coals (mentioned in the table of the map), which, with their concomitant strata, form another basin, the west side of it being inclined at a high angle. They also unite at the point, as represented on the map, something like the bow of a boat. The strata of the preceding section, with its five limestones, and two seams of coal, pass under this second basin, and reappear on the sea-beach, not at all altered, every line of stratification and every rock being precisely the same as at the point where we first examined them. This has long been known, for, after having spent a considerable time in exploring this quarter, I made a search for the descendants of the managers of the Pittenweem Colliery (which has been standing for many years), and most fortunately got a sight of a collection of old plans, which have thrown much light upon the subject: among the rest a curious old document was discovered, entitled "A view of the sea rocks at and east of St Monance at low-water." Upon comparing this with my sketch-book, I found them exactly the same; and it was from this I obtained the local names I have used. This interesting paper seems to have been well handled, and, to add to its curiosity, there is a copy of a tavern bill on the back of it, partially erased, and, if we may judge by an item for breakage, the old geologists must have made merry over it. As we proceed inland, we find other eleven seams of coal occupying the interior of the basin, and they also all unite at a point like the St Monance seams. An examination of section 2d, which is taken across the basin farther inland than the coast section, will shew the form of it. In this section,

notwithstanding its comparatively large scale, I have found it impossible to draw lines so close as the seams of coal are, for within a space of thirty-five feet there are found the first four of the Pittenweem seams. They are named the "Four Plies," I should think from their being so near each other; the thicknesses are given in the table on the margin of the map. About fifty feet from the "Four Plies" we find the "mid-coal," and thirty feet from this we find the "fore-coal," which is the first of the "six coals," and are all included in a distance of a hundred and fifty feet. These coals have been wrought to a depth of seventy-six yards, and the bottom of the trough or synclinal axis of "My Lord's Coal," "Foul Hose Coal," and the "Brassie Coal," passed over, so that there can be no doubt but that all the other coals and limestones pass under them. The second or St Monance basin is only known to contain the "Harbour coal," and the two seams accompanying the "white and Abercrombie limestones." I should think, however, that if proper search were made, two other coals would be found under it, as it is probable that the "Harbour coal" is the St Monance "thick coal" bent in here, and the anticlinal axis abraded off. This will be better understood by referring to the circular dotted line connecting them on section 2d.

The St Monance coals were lately wrought, and the workings proceeded as far north as the county road, where they got thinner and flatter, and their line of bearing gradually turned round in a north-westerly direction, as shewn by the dotted lines. Crops of coals were seen up the country, near Abercrombie, which were supposed to be the St Monance seams. On the east side of the Pittenweem basin the coal was wrought about 300 yards farther north-east than the farm of Waterless, where they also got flatter. The limestones are known to extend much farther up the country.

This small double basin, not much exceeding a mile across, is a perfect epitome of a coal-field. It is bounded on both sides

by the encrinal or carboniferous limestone, and contains coal and all the other rocks usually found in coal districts. But it is impossible to conceive that the various materials, forming the highly inclined edges of this trough, could have been arranged and successively deposited into their present position by the agency of water alone; while we can readily understand how such large concave areas, as are formed by the estuaries of large rivers, may have had layer upon layer of various materials superimposed upon each other in beds of equal and regular thickness

That these rocks have been turned up and twisted into their present position by subsequent mechanical violence, I shall endeavour to prove. The mass of trap at St Monance, and all along to Elieness, bears evident marks of having been ejected from beneath. In passing over this part of the section, I mentioned the occurrence of much confusion,—detached pieces of coals, limestones, and other rocks. Upon comparing these with the rocks of the Pittenweem basin, it will be found that they are the broken wrecks of the same strata. I particularly noticed the thin blue bed of limestone (sect. 2.), which occurs *in situ* under the “Suttie Limestone,” B, on the east of the basin. It here appears at two or three different places and positions, sometimes vertical, at other places flat, and confusedly mixed among the other ruins. I conclude, therefore, that the Pittenweem and St Monance coals and limestones once extended west, and dipped under an angle, conformable with the Earlsferry coals; that an outburst of melted trap occurred between Ardross and Newark which broke up and distorted the strata; that the fused matter continued to flow slowly out of this opening, and coming from under the strata of the Pittenweem basin until it gradually sunk down to its present position; that the sinking in of the basin must have been slow and gentle, is evident, from the fact, that the strata are not broken on the east side of the basin, while on the west side, which has been lifted by trap, two faults appear in

the "Suttie and White Limestones," and the argillaceous strata are crushed thinner at some places, and twisted into waving lines at others.

It is quite surprising to what an extent hard and solid strata will bend without fracture, if the force is applied gradually. We have good practical examples of this in working coal the long way; that is, taking all the coal out, and allowing the roof and pavement to meet, or nearly so (any waste or rubbish made in working the coal, and the cuttings of the roads, being usually thrown in to keep it up a little). In such cases, when the roof consists of shale or slate-clay, it absolutely bends like a piece of flexible leather, without fracture. Roofs of sandstone even, also bend easily; but upon examining them, minute rents, not so much as a line in width, are discovered. It is upon record that one of the Kellie coals (afterwards to be described), which has a limestone roof three feet thick, in the course of "harrying" (or taking out all the pillars that support the roof), about forty square yards of the limestone was left without a prop, and that it stood for a considerable time, and then gradually sunk down to the pavement, a distance of five feet, without fracture. Now, if we suppose the gradual raising and depressing of the Pittenweem basin to have been assisted by heat from the trap rocks, it is no longer surprising how they are so much contorted without fracture; perhaps the small strings and veins observable in the limestones are the minute cracks now filled with calcareous spar.

I have already mentioned how far these coals are known to extend inland. I should think, however, that they flatten out, and occupy a greater surface of country, and will be found to follow the limestone through all its course. I shall be able to shew as large a quantity of coal immediately above the limestone at another place. The dotted lines in the map, running out to seaward at St Monance, are merely put there for the convenience of easy reference. I have no doubt, how-

ever, but that they proceed in that direction, and assume their regular and original dip when they are clear of the trap-dyke.

We have now examined an entire section of the East of Fife coal-field, over a space of about twenty-one miles; on the west, above the carboniferous limestone of Tyrie, and Innertiel, which, upon comparison, very much resemble what we have been describing at Pittenweem; twenty-nine seams of workable coal of the aggregate thickness of a hundred and nineteen feet six inches were described; and on the east outcrop from Earlsferry to Pittenweem, we have pointed out thirty-one seams of coal, amounting in thickness to a hundred and thirty-nine feet eleven inches. The coals on each side of the basin have a considerable resemblance to each other, and, it is more than probable that this extensive basin crosses the Frith of Forth, and joins that of Mid-Lothian. On each shore we find coals wrought as far under the sea as it is profitable to work them. I am possessed of little information regarding the Lothian field; the detached papers and sections which have appeared are not unlike the Fife ones. A detailed account of that coal-field would be of considerable geological interest, for it is quite possible that the connexion between the strata of Fife and Mid-Lothian would then be satisfactorily established.

The following section, from the carboniferous limestone (descending) was taken of the coast as far as Pittenweem Harbour, and will serve to shew the nature of the strata under it. The coals are all very inferior, and at the present day would not be thought worth the working.

[Section of Strata under the Thin Blue Limestone E, (map.)

	Yards.	Feet.	In.
1. Shale,	5	2	0
2. Sandstone,	8	0	0
3. Shale,	5	1	0
4. Shale and ironstone, with carbonaceous matter,		0	0
5. Shale, with thin beds of sandstone,	8	0	6

	Yards.	Feet.	In
6. Sandstone,	3	0	0
7. Shale,	6	0	0
8. Sandstone,	3	0	0
9. Shale, with a great many bands and balls of ironstone,	5	0	0
10. <i>Slaty Coal</i> ,	0	1	0
11. Sandstone, with Shale partings,	4	0	0
12. Sandstone alternating with thin beds of slate-clay, shale, and ironstone,	33	1	0
13. Hard sandstone,	5	0	0
14. Shale,	0	1	0
15. <i>Coal</i> ,	0	1	0
16. Sandstone, with a thin bed of shale,	6	0	0
17. Shale, with alternations of sandstone, and much ironstone in beds and bolts,	23	0	0
18. Yellow sandstone,	6	0	0
19. Sandstone, with alternations of shale and ironstone,	33	0	0
20. Sandstone,	4	0	0
21. Shale, with much ironstone,	23	1	0
22. Sandstone, with slate-clay partings,	6	0	0
23. <i>Coal</i> (very coarse)	0	0	6
24. Shale and slate-clay, including 6 inches coal,	20	0	0
25. Sandstone, with shale partings,	25	0	0
26. Bituminous shale, and coal in alternate laminæ,	2	0	0
27. Shale, with large irregular balls of ironstone,	2	0	0
28. Slaty coal, with shale and ironstone,	2	0	0
29. Soft sandstone,	11	0	0
30. Large granular quartzose sandstone,	16	0	0
31. Shale, with a band of ironstone,	12	0	0
32. Conglomerate of sand and ironstone,	0	2	0
33. Sandstone, with whole partings,	5	0	0
34. <i>Coal</i> , with alternate layers of shale,	0	1	6
35. Sandstone,	3	0	0
36. Variegated sandstone,	33	2	0
37. Shistose sandstone, with thin shale,	3	0	0
38. White sandstone,	15	0	0
39. Shale,	2	0	0
40. Ferruginous sandstone,	13	0	0

	Yards.	Feet.	In.
41. Shale,	16	2	0
42. Sandstone, with ("cat-heads") nodules of iron,	27	0	0
43. Shale,	25	2	0
44. Shistose sandstone,	5	0	0
45. Shale,	11	0	0
46. Sandstone,	9	0	0
47. Shale, with many ironstone bands,	21	0	0
48. Sandstone, with a thin bed of shale,	20	0	0
49. Shale,	14	0	0
50. Sandstone,	30	0	0

At this point there are appearances of trap, calcined ironstone, shale, coal, and burned fire-clay, all mixed together. My survey of the coast ends here; the influx of the tide preventing any farther inspection. This confusion occurs at Pittenweem Harbour, which will be the starting point, should I ever resume the survey.

II. 1. *Kellic Coals*.—These coals, so important to the geologist, are otherwise of comparatively little value. There are two seams, A, B (section 7th Plate IX.); the "back coal" and the "fore coal." The "back coal" is nine feet thick, has three shale partings in it, about equal distances from each other; there are nine feet of roof, composed of hard black bituminous slate, of a peculiar character, seeming to resist the action of the weather for a long time. This coal is the westmost on the map, and about forty-four yards under it lies the "fore coal," which is of variable thickness, from four and a-half to seven feet. It has a shale parting two inches thick, about two feet from its pavement, and three inches of slate-clay near its roof, which is composed of hard shell limestone, about three feet thick. No mining operations were going on here when the survey was made, and the peculiar nature of the roof of both coals was of service to us in ascertaining the pits on each of the coals, and enabled us to trace them satisfactorily through a distance of six miles. They are the most regular lying coals

on the east side of the basin, and distinctly prove its form, as they dip west at an angle varying from 11° to 15° . They are first known about four hundred yards to the north of Balcaskie House, at AB (map), and would seem to have been wrought by a line of old pits up to the fault, No. 1, (map and sec.), where they appear to have been thrown up about forty yards; but of this we are not at all certain. From this fault they proceed north, to within a hundred yards of Kellie Castle, where they meet the large fault, No. 2, which throws them up to the north 180 yards, and shifts them east to the village of Arncroach. As the miners approached this fault, the "fore coal" increased in thickness to thirteen feet, and the dip became more rapid.* From Arncroach they proceed northward in the direction of Kellie Law, as shewn on the map. In this streak they meet with the two trap dykes, No. 3. and No. 4, which do not shift the strata, but the coal in their vicinity is deprived of its bitumen, and is nearly blind.

Proceeding still north, we meet the fault, No. 5, which throws the coals up to the north three yards; beyond this they proceed a short distance under the overlying trap of Kellie Law, and are there turned up nearly on edge by the ejected matter of that hill; they are much spoiled, and nearly blind. We next find a triangular piece of them, enclosed in the porphyritic greenstone of the hill, and lifted up seventy yards, (sect. 7.); only the "fore coal" was wrought on the hill, the "back coal" being so near the trap was completely destroyed, being coked and blind. No clearer proof than this could be afforded, that the hill has been forced up through the coal strata in a state of fusion. On the west it is composed of slightly inclined three-sided columns of basalt, interlaced, and the interstices filled with calcareous spar; the summit is also basalt, some of it amygdaloidal. The western

* See probable reason of this phenomenon at foot-note on page 345, chapter of Faults.

slope is trap-tuffa and earthy greenstone. The south cleft or wing, enclosing the coal strata, is greenstone porphyry. This hill also exhibits evident marks of diluvial action; the western face is more precipitous, and bared to the hard basalt, while the eastern slope is more gradual, and is composed of soft tuffa; and towards the base of the small hill a considerable thickness of gravel is visible. The cleft in which the Kellie coals are is also grooved out lower than the trap, and on the north side of the hill the sandstone is cut into a deep valley, where it comes in contact with the hill. It is impossible to say how much of it is overlying to the eastward; it is certain, however, that this has been another volcanic rent. To the north of Kellie Law, as far as Upper Carnbee, the ground gradually rises; and although the coals are wrought all the way, as seen by the old pits, yet no record is left of the faults (if there be any) which occurred in this distance. The fault, No. 6, at Upper Carnbee, is laid down, from an apparent shift west of the line of old pits. Its extent, therefore, cannot be ascertained with precision, but it is a throw up to the north. Proceeding north for half a mile, the coals are intersected by the trap-dyke, No. 7, which has shifted them neither up nor down: the effect produced on the coals is described in these words,—“On each side of it, for a distance of one and a-half fathoms, there was strong, hard, foul run coal,”—from which we may infer that it was altered by the trap. Still going north, we meet fault No. 8, which shifts the coal up four yards; and a little farther on, fault No. 9, (part of section 7th Plate IX.) which shifts the coals up six yards, the strata now dip under a greater angle, which has the effect of bringing the lines of crop nearer to each other on the map. The coals are next met by dyke No. 10, which is supposed to join the mass of trap to the west of it. A stone mine was driven from Kingcairn Mill to this point, and no coal found; it was therefore concluded that the coal was entirely cut off by the dyke. I should rather think they are shifted under the adjoining trap. Section 7th termi-

nates here, as I could no longer get account of the faults, which is the principal use of the section. The Kellie coals are next seen at Kinaldie, (map) and have been wrought there. I picked up, on the old coal-pit, the shell limestone of the "fore coal" roof, and it is from this circumstance that I suppose this coal to have been wrought here. There are no records about this working that I could get access to, if any exist. These coals are next known to be at Gilmerton; they bear and dip as represented on the map, and I have dotted connecting lines between them and Kinaldie. There are no written documents about this place, but the bituminous slate of the "back coal" was picked up; and my assistant assured me that he had been in the workings many years ago, and distinctly recognised the "back coal" by its black roof, and three white shale partings.

I now lose sight of these two coals, and quit them with regret. From them I have ascertained the general line of the east side of the coal-field, and also have been enabled to bring to light some of the interesting geological changes that have occurred since the deposition of the coal strata. By them we have likewise seen, that the same elevation of the land has taken place, by the same means, as at the point nine miles distant, described at page 276. I must now conduct the reader back again, to notice several crops of coals, which I expect will be found to accompany or follow the same line of bearing as the Kellie coals. A little west of Carnbee, at Gordon's Hall, (see map), two coals were seen in draining; one of them two feet four inches thick, the thickness of the other was not ascertained, but it appeared workable. A two feet coal was also seen between Kellie Castle and Ovenstone; and judging from the distance it is from the Kellie coals, I should think it is one of the same series as was seen at Gordon's Hall. In the stream or burn a little west of Wester Kellie, a seam of splint coal, three feet thick, and dipping west at an angle of 20° , is seen. There was also seen in the

same burn, west from Arncroach, a coal three and a half feet thick. We now proceed to trace the Balcarres coals.

2. Balcarres Coals and Limestones, and their interruptions. These coals are first known to lie in the position marked on the map at ABCDE, and section 4th Plate VIII. about a quarter of a mile north-east from Colinsburgh; A is six feet thick and said to be splint, B is named the two feet splint, C the three feet coal, and D is called the "marl coal." This latter is divided into two; the lower stratum is three feet thick, the upper two feet, and very soft. There is a bed of soft white argillo-arenaceous marl between them, hence its name "marl coal." E, the limestone, which is fourteen feet thick, compact, of a whitish-grey colour, with few or no organic remains. The quarries are all shut up, and my specimens are weathered; I had thus no opportunity of making a proper search for them. The six feet splint A dips under an angle of 20° ; its dip has been increased by the ejection or forcing in of the Balcarres-craig among the strata, between it and the two feet splint B. I was at first induced to consider this picturesque rock an overlying mass, from the circumstance of the two feet splint B having been wrought under it. A more attentive examination of the appearance it presents on the north in the Den, convinced me that it has either been ejected or forced in among the strata in a somewhat conformable position (see sect. 4), and this has increased the dip of the six feet coal A. This craig is connected with the adjoining hill of Kilbrackmont Knock on the east, and on the west it is connected with Coates or Charleton Hill. I shall have occasion to notice it again in describing the Rires Coal Basin. It is level with the soil, except at the craig which rises abruptly between the county road and Balcarres Den, (the rivulet on map). It is composed of basalt, disposed in four-sided columns, irregular in their form, and slightly inclined north, but nearly vertical. It is quarried for road me-

tal, and the west side of it is thus bared, and its structure well exposed. An idea of its form will be obtained from section 4. It forms a prominent and beautiful feature in the landscape, being planted with wood, and on the top a tower and arches have been built to resemble a ruined chapel. The grey tops of the basaltic columns are seen rising in terraces on the south cliff, and, while they add to its beauty, convince the traveller at a considerable distance that it is a trapean rock. The six feet coal A is known to extend in a north-easterly direction, not exactly parallel with the other coals BCD, its course being interrupted by trap. It passes under the overlying trap of Kilbrackmont Knock and Kilbrackmont Craigs, and is said to have been wrought under it, but the distance is not certain. I have therefore dotted it in that direction. The other three coals BCD, and the limestone E, proceed as shewn on the map, the two feet splint B passing under the basalt of Balcarres Craig, and they are not known to be intersected by faults or dykes until they come within 200 yards of Balmakin, where the trap-dyke, No. 1, sixty yards thick, crosses them, and shifts them a little down to the north. The coal was much destroyed on each side of it, and the limestone was not fit for use, being of a confusedly crystalline structure, and very hard, and when in that state it will not make lime when burned. Proceeding along the line of bearing for 150 yards, the fault No. 2. is met with, which shifts the strata down two yards; after this the coal extends to the large piece of trap or dyke No. 3, (which passes down from Kilbrackmont Knock), where they are interrupted; from the last fault, No. 2, to this point, the coals were found to be bad, and of little value. The "marl coal" was strangely altered, the stratum of "marl" was hardened, and solid trap found amongst it, which gradually swelled out so much, and separated the lower from the upper stratum so far, that they could no longer be wrought as one seam. The angle of inclination is here diminished to 11°.

The Hill of Kilbrackmont Knock, is of a smooth conical form, very regular in its outline (see sketch of it in the distance on section 4th); it has been an eruption of trap, and the large fissure, No. 3 (map), filled with basalt, passes out from its base in the direction of Gibliston House, and crosses the burn between Kellie Mill and the village of Arncroach, destroying all the coals and limestone in its course. Night came upon me, and I had not light to examine it in the burn; and as I had finished that part of the country, I did not wish to ride sixteen miles on purpose to see it. A gentleman of my acquaintance tells me, that it has all the appearance of having flowed in among the strata in a state of fusion; the coal strata are altered, and the shale converted into porcelain jasper, having blue lines passing through it. On the east of this trap the coals BCD have been seen, and the limestone wrought at different places in the line seen on the map. About 300 yards west from Gibliston Farm there is an interruption in the line of the quarry, as if it had been interrupted by a dyke; but I have got no account of it, and have therefore not marked it upon the map. A person who was employed on the Farm of Gibliston to drive a stone mine, when at the point where he knew he should have got the "Three Feet Coal." C, came in contact with a bed of "whinstone" occupying its place, and no traces of coal were visible. This uncommon occurrence would require to be established upon better evidence, for although he was an experienced miner, it is possible that he may have been deceived. The "two-foot splint," B, has been wrought a considerable distance, under the trap of Baldutho Craigs, which proves that to be overlying. Beyond this some of the coals have been found, and the limestone wrought at various points along the dotted lines until they are lost sight of under the mass of trap extending from Bunges to Pitarthie.

III. 1 *Rires Coal Basin*, (section 4th Plate VIII.)—This

is of a trough form, with a semicircular end. It does not measure more than 800 yards across. It is about fifty yards deep, and contains four seams of coal ABCD (map). D is three feet thick, and twenty-nine yards deeper; then C is found, which is six feet six inches thick, but not all good coal. Eight yards lower B is got; it is one foot six inches thick; and, two yards lower, we have the "main coal" A, five feet six inches thick, with fourteen inches of black slate-clay in it. The semicircular end of the trough is surrounded by trap, on the west by Charleton Hill, and on the south by the protruded piece which connects it with Balcarres Craig. Very near the trap on the west I observed the crop of a coal which had been thrown out of a ditch, and apparently on edge. I consider the semicircular end to have obtained its form from the forcing up of the surrounding trap, and that only one of the sides of the basin is the original dip. There is a fault, No. 1, which passes across the basin, but it produces little alteration on the level of the strata. To the east of this the coals are said to bear in the direction of the dotted lines on the map; the north crop of them is said also to extend up to the overlying mass of Kilbrackmont Craigs; and, a little farther east, there are numerous old pits which have been wrought for nearly a century. The story concerning them is, that they wrought four seams here, every way similar to those at Rires; but that they were so shattered and convulsed with small faults, that they proved very unprofitable, and were of so limited an extent, that, in the course of driving a mine from the burn a little to the westward, to take off the water, the coal was all wrought out by means of a horse gin, before the mine was finished; it was driven in "good coal metals," so that the basalt must be overlying. As these coals occupy a higher level than those at Rires, it is probable that they were lifted up or floated by the underlying trap at the period of the eruption of Kilbrackmont Knock, but this is not confirmed by any proof or observation.

Between this and Largoward the four Lathallon coals are found ; they are supposed to lie at VWXY on the map, and section 9th Plate VII. They have been wrought, but to what extent I have not been able to ascertain : they dip to the S. E. under an angle of 10° . Two of them are known to be three feet thick, and the other two are two and a half feet thick, all of them splint, and said to be of good quality. I suppose them to extend as dotted on the map. Such is the meagre outline I am obliged to give of these four coals, after being at a good deal of trouble to obtain information about them ; and I believe I have had access to all that is recorded.

2. *Largoward, Bung's, Fallfield, and Lathockar Coals and Limestone* (map.)—This is a most complicated and convulsed district, and I almost despair of being able to give the reader even a general idea of it. The coals are first found a little to the north of those last described at Lathallon ; they occupy a surface of about two square miles, and in that space they are scattered, dislocated, and tossed about in the wildest confusion by large faults, and the surrounding and underlying trap-rocks. There is no correct plan of the workings. About thirty years ago, before the field was well understood or explored, a plan was made which represents the crops of the *same* coals, scattered here and there, and no faults nor dikes shewn. This plan has never been extended with the workings, and, to look at it now, it is sure to bewilder and mislead, and yet it was executed by a person rather eminent in the profession. But it must be kept in mind that the district was not then explored or understood. I have made out two sections to assist the illustration of the map, but they are taken across the simplest places, and the line of the largest one is so curved to obtain a view of the faults and coals, that it does not convey any thing like a distinct idea of the confusion that prevails, and besides, the lines of crop on the map are difficult to be understood without frequent reference to the section. To make the matter less complex, I have excluded some

of the small faults, and have only shewn those that shift the strata considerably. The coals, as they occur in the following section of the strata, have capitals opposite to each, which are used to point out their position on the map, and sections 9th and 10th (Plate VII.)

Section of Strata connected with the Largoward Coals.

	ROCKS.			COALS.	
	Yds.	Ft.	In.	Ft.	In.
1. Alluvium,	4	0	0	...	
2. A. "Parrot Coal," . . . . .	...			2	0
3. Sandstone,	4	2	0	...	
4. Shale,	1	1	2	...	
5. Sandstone,	1	0	2	...	
6. Shale,	1	1	8	...	
7. Sandstone,	1	0	0	...	
8. Shale,	1	1	6	...	
9. Sandstone,	1	1	6	...	
10. Shale,	1	0	4	...	
11. B. The "Thick Coal," . . . . .	...			13	0
12. Shale,	4	0	0	...	
13. Shale and slate-clay,	4	0	0	...	
14. Sandstone,	4	0	0	...	
15. Shale,	4	0	0	...	
16. Sandstone,	4	0	0	...	
17. Slate-clay,	4	0	0	...	
18. Sandstone,	6	0	0	...	
19. Shale,	3	0	0	...	
20. Sandstone,	4	0	0	...	
21. Shale and slate-clay,	6	0	0	...	
22. Very hard sandstone,	0	2	0	...	
23. Sklut, (argillo-calcareous rock),	2	1	0	...	
24. Very hard sandstone,	0	2	0	...	
25. C. "Marl Coal," . . . . .	...			4	0
26. Slate clay,	3	0	6	...	
27. Sandstone,	3	0	6	...	
28. Slate-clay and shale,	2	0	0	...	
29. Sandstone,	2	1	0	...	
30. Shale and shistose sandstone,	6	1	6	...	
31. Shale, with laminæ of coal,	2	0	0	...	
"Little coal," irregular, (therefore not in					
map,)	average			1	8

	ROCKS.			COALS.	
	Yds.	Ft.	In.	Ft.	In.
32. Sandstone,	4	0	0	...	
33. Hard black slate-clay,	2	0	0	...	
34. Sandstone,	3	0	6	...	
35. D. " <i>White Mire Coal</i>," . . . . .	...			2	6
36. Sandstone, thickness variable, average	24	0	0	...	
37. Alternations of shale, slate-clay, and sandstone,	16	0	0	...	
38. Limestone,	0	2	0	...	
39. Calcareo-argillaceous rock,	3	0	0	...	
40. " Bastard coal," not on map, coarse, stony, full of calcareous spar and pyrites, (useless),	1	1	0	...	
41. Sandstone,	3	2	0	...	
42. Alternations of shale, slate-clay, and sand- stone,	8	0	0	...	
43. " Pelt and Rum,*	2	0	0	...	
44. E. " <i>Splint Coal</i>," . . . . .	...			4	0
45. Sandstone, with alternations of shale and slate-clay,	24	0	0	...	
46. F. " <i>Black Coal</i>," . . . . .	...			3	0
47. Sandstone,	8	0	0	...	
48. G. " <i>Lower Coal</i>," . . . . .	...			2	0

Most of the faults at Largoward form acute angles with the lines of bearing, and therefore throw the same coals successively to the surface. Thus, in proceeding from north to south along the line of section 9th, we pass over the same coals four times. In going north, the fault No. I. throws up six yards; on the south of it the coals C B are found, dipping south, and bearing east and west in a semicircular form. On the north of fault No. 1, the same coals C and B are found, dipping north, and bearing east in a circular manner, as if they were to meet, and form a circle having a qua-qua-versal dip from a common centre. The strata here must

* "Pelt and Rum," a curious local name. This substance is bituminous shale and slate with films of coal, sometimes passing into parrot coal. It burns with a loud crackling noise and considerable flame, leaving a "ghaist" little diminished in bulk.

have been pushed up at one point to have produced this effect. The next fault, No. 2, (Sect. 9th), throws up to the north 140 yards; the next one, No. 3, throws up ten yards. This fault extends as far west as the coal is worked, but on the east it runs only within a few yards of the trap-dyke No. 7 (map), which seems merely to have been a fracture or chasm filled with basalt, as it does not shift the coal up nor down. From it the cross trap-dyke, No. 6, proceeds to the centre of the Bungs ridge, but does not shift the strata. The fourth fault, No. 4, throws up to the north 120 yards, and about half a mile farther on the fault No. 5. throws up, in the same direction, 110 yards. The coals between the faults No. 1. and 2 extend west nearly to the trap at South Fallfield, where they get blind before approaching it, and are thus destroyed so much as to be nearly useless. The coals contained within the other faults to the northward, do not extend so far west, being also destroyed by the trap that extends east from Dunnicker Law by Cumberland. The line of section now turns round, and crosses the protruded mass of trap near West Lathones, and then crosses the Fallfield coals, which bear and dip as represented in the section and map. These coals are known to be the very same as E and F at Largoward, (section 10th and map.) They are thicker, but the roof and pavement are same. The lower stratum of the "Pelt and Rum" is here a good cannel coal, and the two feet limestone observed in the section, is here, in its relative position, above the coals. It is very difficult to conceive the amount of fault that would be necessary to bring these coals here.

The complication of the Largoward field is considerably increased by the Bungs Hill or ridge having been raised up, and causing the strata to assume the saddle-back or mantle shape, as shewn on the map and section 10th, which is taken across the ridge, and shews its structure. The "Black Coal" F does not come to the surface upon either side of the saddle-back, but is interrupted by trap and confused sand-

stone, (see section 10th). A bed of this trap has insinuated itself among the sandstone. It was found in sinking the pits, and is of very variable thickness, sometimes fourteen, twelve, and diminishing to five or six feet; and the last pit, which was farther to the dip, did not meet with it at all. The people about the place could not tell me what effect it had produced upon the strata; they shewed me the rock, however, which was granular greenstone. On the south side of the saddle-back the coals meet with trap-dyke No. 6 (map), and fault No. 8, which, however, do not much alter their position. After this they proceed east as far as the trap of South Cassingray; they have not been wrought this length, and it is not known whether they are cut off or proceed under this mass.

On the north side of the ridge the coals are intersected by fault No. 9, (map) and proceed eastward as far as the trap-dyke No. 10, where they are turned up in a vertical position, and beyond this they have not been seen. There appears to have been an outburst of trap at the Hill of Cassingray, to the east of Bungs; and, before it burst forth, I should suppose the Bungs ridge had been gradually elevated, until the disturbing cause was removed. The faults found on the ridge (none of them shifting the strata), are exactly like what we would conceive the fractures to have been, had the strata been broken by being pushed upwards. In consequence of so much disturbance, many small rents and minute fissures abound in all these coals, these are now filled with calcareous spar and pyrites; the abundance of the latter substance causes the small coal and rubbish left in the wastes to take fire spontaneously, which obliges the proprietor to send the rubbish to the hill.

Had the ruined fragments and broken edges of the varicus upraised masses of Largoward been all exposed to view, exactly as they were after the convulsion, it would have been a frightful spectacle, yet it would have been easier explained then than now, when all traces of violence are obliterated

from the surface. This place, once the scene of extraordinary confusion, is now smoothed over, and formed into pleasing hills and plains by the action of a former sea. Much has been said by physico-theological writers and others about the blessings, and convenience, of dykes and faults to miners. A few of them may be convenient, but assuredly such a number of them as we have in Fife is by no means desirable.

The two Fallfield Coals (part of Section 9th, Plate VII.) as already mentioned, are the same as E and F (Section 10th) of Largoward section; they bear and dip as represented on the map, and are cut off on the north by the ridge of trap extending from Lawhead to Radernie.

The western drift of them, seen before Fallfield House, was known to have been wrought under the basalt of Dumnikier Law. This hill is the highest land in this survey, (I had no instrument with me at the time to measure it, but I saw that it was considerably higher than Largo Law). It is composed of fine-grained basalt, arranged in large five-sided columns, which separate at the transverse joints into blocks from twelve to fifteen inches thick, which are quarried extensively for road-metal. A considerable supply of water is obtained from it, which flows at all seasons of the year. A reservoir is formed on it, which supplies Fallfield House and the adjoining grass-parks. About half a mile north-west from this, a little to the north of Patie's Hill, a bore was put down, and two or three coals found of a workable thickness, but I have not succeeded in getting a particular description of them.

We have now to notice the Lathockar four coals and limestone, seen at W, X, Y, Z, A, on the map. W is four feet six inches thick, and is named the "Cherry Coal." X the "Marl Coal," is three feet four inches thick, with nine inches of slate-clay in it. Y, the "Duffie Coal," is three feet thick, having four inches of shale in it. Z, the "Brassie Coal," is three feet thick. A, the limestone, is nine feet thick at Lathockar, of a dull whitish grey-colour, and contains few

organic remains ; what are seen are very minute shells, almost microscopic. The various positions in which portions of these coals and the limestone are found is a perfect enigma, and I can do no more than point out where they lie. I have sometimes thought they were above the Largoward seams, while at other places they appear to be below them. They are first seen between Lathockar and Brewster-walls, and have been wrought there to a depth of twenty-four yards. They bear south-west and north-east, and form a segment of a circle. They meet with some interruption, and are again seen a little to the east of Lathones, dipping west, while the Largoward coals at Lathones dip east, about 300 yards from this place. They are next seen at Radernie, bearing and dipping as represented on the map ; on the north-west they are shifted by a protrusion of trap, or large dyke, that passes off from the trap of Lawhead, and goes through the village of Radernie, and beyond this the limestone was once wrought, but much altered in quality. In the streak of the Radernie Quarries, the trap-dyke, No. 12, passes through them, as shown on the map. On the south-east they are shifted by the trap-dyke, No. 11, but how far is not known : the dyke, however, is known to pass through among the Lathockar coals. The coals W, X, Y, Z, are next seen about 200 yards to the south of Lathones toll-bar, and no more is known of them. The limestone at Radernie has not the same appearance that it had at Lathockar. It is here of a dark bluish-grey colour, and of much better quality. I have been told that two of the Largoward coals have been seen between Cross-Bowers and Radernie. It would thus appear that the same complexity and confusion prevail here as at Largoward. I have been compelled to leave the place without understanding it ; for the more I inquired the more I met with to mystify the subject ; should the mining operations ever be carried forward, the matter may perhaps be better unravelled.

There is a limestone quarry a little to the south of North

Bank, which stretches east and west, and dips as seen on the map. This quarry is shut up, and I have not ascertained the thickness of the limestone; a coal accompanies it; it is three feet six inches thick, and good splint. There is also a quarry of limestone, about 400 yards north from North Bank (see map), also shut up; and no account of its thickness could be obtained. Having now noticed all the minerals visible in this part of the country, we return, as originally proposed, to the Athernie trap-dyke, to describe the course of the limestones and coals to the north of it.

IV. 1. *Lundie Coals*.—In my survey of last year, I examined and identified three of the Wemyss seams which had been wrought nearly up to the Athernie dyke. Although only three seams are represented on the map, at that point, we must not conclude that these are all that the field contains. In this map nothing is laid down but what is absolutely certain, the dotted lines, denoting the supposed course of certain coals, are not merely imaginary; some account of all such has been received, and the direction is the only thing that is supposed. It is extremely probable, therefore, that something like the original number of seams, with which we set out, may be afterwards found in the neighbourhood of these coals. I have good reason to believe that other coals have been wrought so long ago that no trace or tradition is left of their position, extent, or thickness. Thus in the flat sandy soil between Leven and Lundin Mill, I have noticed patches of the various materials of the coal strata, ploughed over, and rendered arable. These patches, I conclude, must have been the rubbish of old pits, of which no record is left. The reader must not suppose, as he studies the map, and finds the crops of coals gradually diminishing in number as he proceeds inland, that less coal exists there than at the coast, which being nearest an extensive market have been better explored. At several points in the interior, the violent distortions produced by the

trap-rocks turn up, and expose to our view such abundance of coal, that we may reasonably infer the whole country within the limits of the carboniferous limestone, to contain quite as much coal as we have found on the sea-coast, except at such places as are destroyed by the evolution of the igneous rocks.

Beyond the Athernie dyke, twelve seams of coal have been discovered, and eight of these have been described in division first, under the name of the Drumochy Coals. The seams A, B, C, (map) are named the "Lundie Coals," and were wrought about sixty years ago. There are only two men alive who wrought them, and from them the following information was obtained. A is eight feet thick ; two feet from the pavement there is a parting of shale ; then one foot six inches of splint ; and all above is cherry. B is said to be four feet thick, and of a soft nature ; the thickness of C is not known, but it was generally reckoned inferior to the other two, both in thickness and quality. Nothing was known of D, until a few years ago, when the farmer at Pilmer, in sinking a well for his steam-engine, came upon an old coal waste fully three feet in height : it was also seen in a deep drain about 300 yards farther west, in the same line of bearing. A, limestone, the crop of which has only been seen ; it is thought to be the same limestone as that at Thomsford (to be afterwards described). These coals bear and dip as represented on the map, and were never wrought up to the trap-dyke on the west, being very much troubled, and the coal of bad quality, as noted when describing the course of the dyke. On the east they meet with fault No. 1, which throws them up to the north about seventy yards ; and, beyond this, the same coals cannot be identified, nor can I see any resemblance between them and those I left off at last year. It is therefore impossible to say how much the Athernie dyke shifts the strata, or if it shifts it at all. The ground between the coals A, B, C, and Lundie Mill, is covered up, by a thick bed of diluvial clay, and at one place by a morass, now drained, and

these effectually hide all the coals that may lie under them. I proved the Drumochy coals to be the same as the first seams of the coalfield; it therefore follows that many other seams should be found to occupy this space.

2 Thomsford Limestone and Cairlhurlie Coals.—Beyond fault No. 1, (map) we find the limestone basin of Thomsford (see sect. 4th Plate VII). It is not above 400 yards across from crop to crop, and is not very deep. The limestone is fifteen feet thick, of a grey colour, and imperfectly crystalline, and contains no organic remains. The strata above the limestone, are first two feet of “sklut,” argillo-calcareous rock, containing a very large portion of argillaceous matter, next a thick bed of shale, containing ironstone bands, then sandstone, with a few thin beds of shale. It is remarkably regular, and forms a segment of a circle, and is not known to extend farther than it is represented on the map. On the south crop the coals I and J have been discovered in draining, but never wrought. I is three feet thick, and was seen near North Pilmer. J is fifteen inches thick, and was seen near Hatton Saw Mill, and various other places on the dotted line. Beyond fault No. 1, and about the south crop of the basin, the strata forms an anticlinal axis, and assumes the regular dip of the country. But about a mile farther east, all the strata on the south crop dip conformably with the basin all the way to Largo Law, as seen by the arrows on the map, and by section 4th. The coals I and J cannot be seen in the brook on the north crop of the Thomsford basin. I have dotted them there, on section 4th, as it is extremely probable they conform with the other strata. On the north, about 700 yards from the limestone, the Cairlhurlie coals E F G H, are found. H is fifteen inches thick; G two feet six inches thick, nine inches of it being splint, and the rest of it as slaty parrot coal; F fifteen inches thick, and very soft; E two feet eight inches thick, then three feet of slate-clay, with fifteen inches of good coal above it; but as the coal proceeds eastward, the slate-clay de-

creases in thickness to six inches. 200 yards to the north of this coal there is a bed of blue limestone, very compact, three feet thick, and contains no organic remains. There are also a great many bands of ironstone, which were at one time worked and shipped at Largo. About 900 yards farther north, a thin coal is said to have been wrought along the dotted line, near Mr Pratt's. These Cairlhurlie coals bear as shewn on the map, until they are interrupted and deranged by a large mass of trap, No. 2, *a*, which seems to have been a large fissure or dyke: it is seen passing off from Pratis Hill, and across Cairlhurlie Burn. It frequently stands high up in knolls and clumps, and is there quarried for road-metal; in the burn it has the appearance of the annexed figure.

a, Beds of shale and sandstone; *b*, basalt; *c*, greenstone, with veins of felspar and calcareous spar; *d*, wacke; *e*, altered shale; *f*, indurated sandstone and shale; *g*, small fault.

On the east of this large dyke the coals dip north, and form a kind of semicircle dipping round the basalt which forms its centre (see map). The trap has never been approached by the coal-workings; the coal gets so hard and dislocated in its neighbourhood, that it is not worth the working. The end of this piece of trap has never been seen, although I have shewn it on the map. It is certain that it does not extend much farther than I have repre-



Fig. 3.

sented it, for it is not visible in Kiel's Den, a deep valley at the foot of Largo Law, where the rocks are well seen. Passing over, in a north-easterly direction for about 700 yards, there are no coals known, but much confusion and contortion of the strata, until we come to Brankston, where Fault No. 3. *a*, is found; but to what extent it shifts the strata, there is no means of ascertaining. Beyond it are the coals KL. L is three feet eight inches thick, with five inches of stone in it, and is of a splint quality; K is only fifteen inches thick, and very inferior coal. These two coals extend east for about 400 yards, where they are cut off by the large trap-dyke No. 4 *a*, which passes down from Tequhats, and joins the trap of Largo Law. This dyke at some places is 500 yards broad, and produces considerable confusion on each side of it. Beyond this the Teasess coals are first seen.

3. *Teasess Coals and Limestones.*—These coals can be traced over a considerable distance of country, but they shew no extensive faults. M (map) is two feet thick, one foot of it parrot, and the other cherry coal. N is four feet ten inches thick, with fourteen inches of black slate-clay in it. These coals first meet with fault No. 5 *a*, which shifts them up to the north twelve feet, and also the fault No. 6 *a*, which shifts them ten feet. Beyond this point, and as far as Hallteasess, the coal is very foul, and gradually becomes blind, or deprived of its bitumen. There are some open fissures in these coals, around which the coal is coked into a cinder, and exhibits evident marks of having been heated. A considerable extent of it has been thus altered, and it is therefore inferred that the trap would be found at no very great distance under it. The coals have been wrought at various points along the line represented on the map: sometimes they are of excellent quality, but at the places where they come near the trap, they are blind, or otherwise changed. To the north of Newbigging of Craighall, they are thrown up twenty yards by the fault No. 7 *a*, and about 200 yards farther on, they are interrupted by the

ejected mass of trap No. 8 *a*, where I must leave them, and return back to notice the limestones.

There are three quarries of limestone to the north of the Teasess coals, at C, B, A. A is called the Teasess white limestone, ten feet six inches thick, and divided into five beds. Its colour is whitish-grey. It is very compact and difficult to work. Organic remains are scarce, but I found a few corallines, and, in the shell above, encrinites. It bears and dips as represented on the map, and is interrupted by the trap-dyke No. 1, which shifts its position a little, and also alters the line of bearing. It next meets the fault No. 2, which shifts it a little; and, lastly, it is cut off by the trap-dyke No. 3, and beyond that point it has never been seen. The strata above it are five feet of inferior limestone, containing a large portion of argillaceous matter, fourteen feet of shale, seven feet of sandstone, and twenty feet of ferruginous basalt, disposed in irregular columns or blocks. The sandstone is altered at the point of contact. B is called the Teasess middle limestone. It is ten feet thick, in four beds. It is compact, and of a bluish-grey colour; contains corallines, encrinites, and, I am told, shells, but I could find none, although I made a search for them. It bears and dips as represented in the map, and is cut off on the west by the large trap-dyke No. 4, *a*, which extends this length under the overlying trap of the hill. It is also cut off, or at least interrupted, on the east by the ejected trap of the hill of Teasess; so that all the known extent of it is seen on the map. The strata above it are four feet six inches of inferior limestone, or "sklut," in which there are numerous fissures filled with beautiful incrustations of calcareous spar, and, when the fissures are large, stalactites and stalagmites of a dazzling whiteness are formed. Above the "sklut" there is twenty feet of shale, and one foot of alluvium. C is called the Tequhats blue limestone. It is of a sparkling grey colour, and crystalline. It is eleven feet six inches thick, and in three beds. Organic remains are exceedingly rare in this

quarry. I could obtain none; but encrinites have been found, which the workmen designate by the familiar name of "pipe shanks," and the corallines they call "pipe heads." The strata above this limestone are two feet six inches of "sklut," then eighteen feet of shale, containing a good deal of pyrites, which sometimes also occurs in the limestone. Above the shale are five feet of sandstone, and four feet of alluvium. This limestone is cut off on the west by the large trap-dyke No. 4 *a*, and is known to follow the Teasesess coals east all the way to Craighall, where it is wrought. It is spoiled at some places, like the coals, where the trap happens to come near it.

There is a great similarity between these three Teasesess limestones. They are all about one thickness, their structure and fracture resemble each other, the strata above them are similar, and the organic remains are the same; and it has been conjectured that they are the same bed of limestone, thrown up successively by faults, passing parallel to their line of bearing. When I was on the spot, I was not at all willing to adopt this supposition, which was suggested by Mr Williams of Teasesess colliery, but in the course of my other explorations of the carboniferous limestone of Fife, which contains three beds, having very distinct characteristics. Now the Teasesess limestone only resembles one of these beds (there never has been depth to see the upper, and no excavation made for the lower bed), and it is from this circumstance I am inclined to adopt Mr Williams's idea as highly probable, the whole of the hill being composed of trap, having in some places the appearance of an ejected mass; and we have already given proofs of greater derangement than this having taken place.

Before resuming the tracing of the Teasesess limestone and coal, we shall notice some seams of coal that occur near them, and possibly follow the same line of bearing. First, then, on the dotted line at A (map), between Hallteasesess and New Guilston, there are numerous old pits, said to be upon a thin seam or

seams of coal, but nothing farther is known. Between New Guilston and Clockmydron, a very singular mass of "rum coal," and four other seams, are found under the mass of overlying trap occupying the high ridge from Patieshill to New Guilston. This "rum coal" is an inflammable bituminous shale, which burns imperfectly. It is extensively used for lime-burning, for which it is well adapted, as the large "ghaist" which it leaves after combustion, serves to admit air to the kiln. It is known to be eighty feet thick, and supposed to be considerably more. The whole of it is useful, and it is wrought in an open quarry. On the top of it the coal B has been wrought, but many years ago. It is said to be four feet thick, two feet six inches of it being cherry, six inches "rum coal," and the rest good cannel coal. A is two feet thick, and twenty-five from the top of the "rum coal." The coals CD have been wrought under the trap, and are each two feet six inches thick, and very near each other.

4. *Ceres Coals and Limestone.*—The Tequhats limestone is next wrought at Craighall Castle, and bearing west a little, trains round in a semicircular form to Ceres toll-bar, where it is lost sight of. Before it takes the bend, it is intersected by the trap-dyke No. 9 (map). There is a thin coal found under it at this point; it is twenty inches thick, and the shale above it abounds with terebratula. The limestone at Craighall dips north; but the coals (which I shall still call the Teasess coals) are separated from the limestone by a mass of trap being protruded between them, which has the effect of tilting the Teasess coals and adjoining strata upon edge. A sectional representation of it is given at section 8th, Plate VII.; no part of which is assumed except the outlet of the trap, which, of course, cannot be seen. The piece overlying the limestone is seen; nay more, it was attempted to work the Craighall limestone, by mining it under the high trap-hill. They had not proceeded many yards, however, when the limestone was found to be in broken masses, and full of fissures filled with

ferruginous decomposed trap, and so much altered as to be unfit for use. The roof, although composed of firm shale, could not be supported, from the shattered state of the limestone left as pillars. The mining became dangerous and unprofitable, and consequently was abandoned. The quarries and mines are still open, however, and any one can satisfy himself that the foregoing observations are correct. This tilting up of the strata into an almost vertical position, has brought into notice no less than seventeen seams of coal within a space of 500 yards. And it is very remarkable that there are also seventeen seams of coal as near the limestone at Pit-tenweem, having a considerable resemblance to these. They are named the Ceres coals, and their individual names and thicknesses are noted on section 8th. The following section, taken from an old report, will give the distances between each seam and the strata interposed; and although it is not exactly such a section as a geologist could wish, yet it will give an idea of the alternations, so curious a feature in the coal formation.

*Section of Strata connected with the Ceres Coals,
Sect. 8th, Plate VII.*

No.		ROCKS.		COALS.	
		Yds.	Feet.	Feet.	Inches.
1.	<i>Luncart Coal,</i>	.	.	4	3
2.	Shale and soft sandstone,	20	0	...	
3.	<i>Make-him-rich Coal</i>	.	.	3	0
4.	Shale,	} Wrought as one seam,		0	2
5.	<i>Two-foot Coal,</i>			2	0
6.	Sandstone and shale,	60	0	...	
7.	<i>The Thick Coal</i> —thickness variable; average,	.	.	16	0
8.	Sandstone and shale,	12	0	...	
9.	<i>Four-foot Coal,</i>	.	.	5	0
10.	"Metals very hard,"	6	0	...	
11.	<i>Six-foot Coal,</i>	.	.	6	0
12.	"Metals passable,"	10	0	...	
13.	<i>The Little Splint,</i>	.	.	2	6
14.	"Metals,"	13	0	...	
15.	<i>Bowanton Coal,</i>	.	.	3	0

	ROCKS.	COALS.
	Yds. Feet.	Feet. Inches.
16. Hard stone,	8 0	...
17. <i>Donaldson Coal</i>, . . . . .	...	1 6
18. Hard sandstone,	14 0	...
19. <i>North Coal</i>, . . . . .	...	3 0
20. Sandstone and shale,	8 0	...
21. <i>Little Coal</i>, . . . . .	...	2 6
22. Sandstone and shale,	5 0	...
23. <i>The Five-foot Coal</i> —2 inches of stone in it, . . . . .	...	4 6
24. Sandstone and shale,	2 0	...
25. <i>The Four-foot Coal</i>, . . . . .	...	4 0
26. "Metals passable,"	18 0	...
27. <i>The Whin Coal</i> —"with 2 inches of whin in it,"* . . . . .	...	4 0
28. "Metals,"	2 0	...
29. <i>The Rum or Foul Parrot Coal</i>, . . . . .	...	3 0
30. "Metals passable,"	70 0	...
31. <i>The Black Coal</i>, . . . . .	...	2 6
32. "Metals," . . . . .	...	...
34. <i>Bullfield Coal</i>, . . . . .	...	2 6

These coals and the two Teases ones, are all included with- in the letters A B on the map. They bear in a curved form nearly parallel to the limestone, as represented on the map. I shall endeavour to trace their course, but must inform the reader, that the position of the faults and dykes may not be always mathematically correct, it being so long since the coals were wrought, that there are few who know any thing about them. The document from which I got these faults, was en- titled, "An Eye Sketch, from nothing more than looking at the surface." In the report accompanying this "Sketch," the writer gives the proprietor the following sapient counsel : "I would not advise you to risk any of your green riggs for

* This, upon cross-examination, turns out to be hard black slate-clay. Colliers are very apt to designate all hard stones "whin." I have several times thought I had found out interesting interstratifications of trap, when, after particular inquiry, and an inspection of the stone, it was found to be hard sand-tone.

the chance of what may be below them." That such an advice should be given, and such a quantity of coal in so little space, is very surprising; it may possibly have arisen from the very bad state in which the workings were left. These coals will some time or other be highly prized, and yield a very handsome return; but in the present glutted state of the market, a complicated coal-field cannot be worked to advantage.

From A to B these nineteen seams of coal bear as represented in the map, until they meet with the fissure No. 1. of sandstone, which does not shift their position. No. 2. fault throws them north one hundred yards, but trap-dyke No. 3. does not alter their position, nor spoil the coals; it is described to me as "rotten ratchell dirt." The next interruption is No. 4, which seems to have been a chasm filled with clay, sand, and gravel, and it was thought did not extend to great depth, having been found to diminish in thickness as it descended. These coals now gradually flatten, and occupy a greater surface of country. They have been wrought at Coaltown, at Callange, and at Kinninmont: at the latter place only, the first three of them are known to have been wrought; and in boring to the thick coal, such a deluge of water came from the bore when it entered the coal, that it had to be plugged up, to prevent the drowning of the other workings. The trap-dyke No. 5. I have no record of, I observed trap, and some such confusion as is usually produced by dykes, in the rivulet at that point, but I could not ascertain how much it shifted the strata. Beyond Kinninmont the coals are broken up, and some of them driven aside by the eruption of the trap-hill of Ladedda. The thick coal, and other five of the seams, are tossed up to the top of the Hill of Drumcarro, where they are wrought in the triangular space between the faults Nos. 6 and 7. The south slope of Ladedda Hill has many marks of old pits upon it (of which there are no record), proving that the coals pass along there. In the small piece of sandstone observed between the hills of Laded-

da and Drumcarro, the coals are strangely tumbled about. A bore was put down at one place, and so much were they upon edge, that thirty feet of the bore was in coal. I regret exceedingly that I cannot give a section of this hill, which I think would have been fully as interesting as any of my sections; but so much must have been supplied by the imagination, that I could not risk it in a paper of this kind.

The limestone gets flat, or rather assumes the basin form. It is seen on the north side of Ladedda Hill dipping towards it, and also at Wilkieston; on the south side dipping into the hill, as shewn on the map, thus forming a flat basin with Drumcarro Hill resting in its centre. The basin form is not complete however, for the limestone must be broken up at the centre of the hill as well as the coals. We now propose to describe the coals and limestone as they occur at Ladedda, Drumcarro, and Wilkieston. This limestone, A, is eleven feet thick, of a whitish gray colour, and compact structure. It takes on at what has been considered a trap-dyke No. 8, near Newbigging of Blebo, and bears and dips as represented on the map; it is thrown down to the east, about three feet, by the fault No. 9, and shifted a little also by the fault No. 10. It is supposed to extend to the trap at the foot of Drumcarro Hill. The strata above it is composed of, first, two feet of inferior limestone termed "sklut;" but not like the other "skluts" we have noticed, however, for it is entirely composed of organic remains, united by a calcareous cement, the prevailing fossil being the encrinite, found in all positions, dislocated and studied all over, giving it the appearance of a conglomerate. There are also found the shells of the producta in infinite abundance, a few terebratula, some fish teeth, and scales. Above this "sklut" we find fourteen feet of shale, four feet of shistose sandstone, two feet six inches of shale, fifteen inches of coal A, two feet of brown inferior limestone, eight yards of various strata not ascertained; then coal B, two feet four inches thick, four yards of various strata; then coal C, which is two feet

six inches thick ; then D, the six-foot coal inclined at a high angle ; and then E, the ten-foot coal, almost all vertical. There are other coals on the hill amongst the confused strata, of which I have got no distinct account.

The limestone on the other side of the hill is also eleven feet thick, and similar to that at Ladedda, last described. There is not cover enough to shew the coal and other strata, but a little to the eastward on the slope of Drumcarro Hill, at ABC, they have been wrought. A is two feet six inches thick, splint and cherry ; B is called the " rum coal," it is three feet six inches thick, and sometimes passes into good parrot-coal ; the seam above this is about twenty inches thick, and of inferior quality. The coal on the top of Drumcarro Hill, represented within the triangular space enclosed by the faults Nos. 6 and 7, are elevated to a considerable height by the trap, and are a continuation of the Ceres coals, although somewhat altered in thickness and position : A is three feet ; B is said to be seven feet thick, and sixteen inches of it parrot ; C is also seven feet thick ; D, the " thick coal," varies from fourteen to twenty feet thick ; this coal has three partings of shale in it, one of them four inches thick, and the other two, two inches thick ; E is five feet thick, and F eight feet thick. They bear and dip as represented on the map, and are not wrought beyond the fault No. 6, the extent of which is not known, but all the way to Burnsquare and Coaltown, where the map is occupied by dotted lines, many old coal-pits and other remains of coal workings are found. About a mile to the eastward the same limestone, and some of the coals, have been found. The limestone is wrought at Winthank extensively ; it is eleven feet thick, and so exactly like the last described at Ladedda, that to state it would only be a repetition. The same strata occur above it ; and the same coals ABC, described on the south slope of Drumcarro Hill, are also above it ; and there can be no doubt but that the same limestone extends between the two quarries, more or less interrupt-

ed by faults or dykes. In the Winthank quarry the fault No. 1 throws up to the north about fourteen feet ; it is not ascertained whether it be a slip or a trap-dyke. The limestone is useless for about twenty-four yards on the north of it. The fault No. 2, is thought to shift about ten feet in the same direction, but it cannot be seen, as the public road passes over it. This quarry is the termination of my survey to the north-east, and all beyond, where the colours are shaded off, I have not particularly examined. But I am aware that the same limestone has been wrought at Mount Melville, a distance of about two miles east from this, and within one and a half miles of St Andrews.

V. 1. *Kilmux Coals*.—We now return again to the westward, and endeavour to trace more of the coals to the north-east of Athernie trap-dyke. No coals are known until we go north as far as Kilmux, where the four coals A, B, C, D, are found. They bear in a circular form, and dip from a common centre, as shewn on the map. A is said to be six feet thick ; B four feet nine inches thick, with nine inches of stone in it, about a foot from the pavement ; C two feet two inches thick, with a bed of slate-clay in it eight inches thick ; and D also two feet two inches thick, with eight inches of bituminous slate ("rum") in it. These coals meet with no extensive faults, but have a good many small slips and fissures, filled with threads and films of calcareous matter, which give the coal an unfavourable appearance. The fault No. 1 interrupted the mining towards the dip, and was not cut through, so that it is not known how much it shifts the strata. No. 2 shifts only a few yards. These four seams of coal dip under the moderate angle of six degrees, except at such places as come in contact with the adjoining trap, where the angle is very high in the brook noticed on the map. I observed the strata in a position something like the annexed fig. 4: *a*, basalt of Kilmux Hill ; *b*, alternations of sandstone and

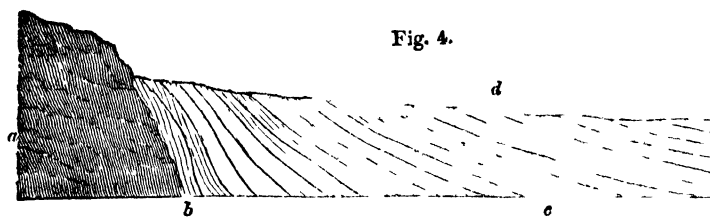


Fig. 4.

shale, very little indurated, *c*, regular dip of the field; *d* alluvium; which shews that Kilmux Hill has either been forced upwards, or in among the sedimentary strata. All along the junction of this trap with the sandstone, the strata are contorted, but not to a great distance. At the place where the coal crops out, and on the spot where the new mansion-house of Kilmux is built, the strata are more irregular than in the figure. About half a mile south-east from this, near the farm of Letham, there is some confusion among the strata; they dip, as shewn on the map, which dip is nearly opposed to the usual dip of this part of the country.

There are no coals known between Kilmux and Carriston. In the strata along Kennoway burn, the various alternations of the coal strata are met with, and often indications of coal. Between Kennoway and Auchtermarnie Mill, there is a great deal of confusion visible among the strata. Proceeding up the burn from this point no rocks are to be seen, until we come near to Bogside, where there is a quarry of sandstone, about 300 yards distant from the top of the Auchtermarnie ridge. As this shews the kind of contortion that is usually found near an ejected mass of trap, I have subjoin-

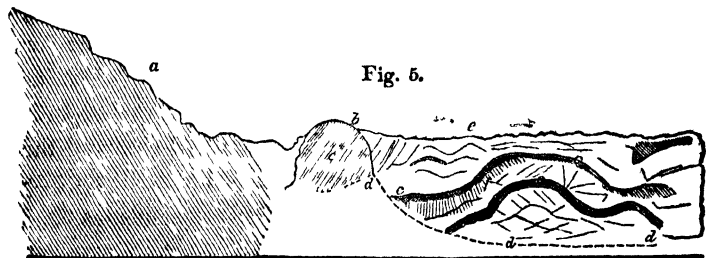


Fig. 5.

ed a sketch of it, fig. 5: *a*, greenstone porphyry; *b*, trap water-worn boulder, imbedded among the sandstone; *c* ferruginous sandstone; *ccc* thin partings of shale, between the beds of which is broken sandstone; *ddd* outline of the quarry. Notwithstanding the distance from the trap, the quarry is so fractured and broken, that no stone can be got out of it larger than for a common dyke. Going still west the burn, we see various small films of coal cropping out, and near the village of Starr, the Carriston coal is seen. And to the west of this there is much appearance of coal. One of the workmen assured me, that in deepening the burn for the purpose of draining the moss, he counted no less than fourteen different croppings of thin coals between the point where the Carriston coal crosses the stream, and where I have noted the crop of a coal. Before tracing the Carriston coals, I must notice a coal that has been seen, not far from the trap-dyke, by Mr Ballingall of Treaton, who, in the course of running a stone-mine to drain a sandstone quarry, met with a coal eight feet thick, which bears and dips as seen on the map. It had an ironstone roof, and a shale pavement. I think this must be one of the Dyr-sart coals, No. 26, of last year's section. It has never been wrought. The Carriston coal is four feet thick, of very inferior quality, and is intersected with faults and dykes very frequently, of which, however, no record is left. It has been wrought at various places along the line shewn on the map. It often decreases in thickness, and gets blind. It is thought to extend as far as the old wind-mill, near Devon, where two blind coals were wrought; and it was generally thought by the workmen that one of these was the Carriston coal: they are known to extend to the trap, and some say under it. These coals burn without flame, and contain scarcely any bitumen; they were only used for burning limestone. About a mile from this, in a northerly direction, the Burnturk coals are found.

2. *Burnturk Coals*, ABCDE (map). A, the "main coal," is three feet six inches thick, and there are six feet above it, composed of alternate laminæ of coal and shale, which are of no use; B, the smithy-coal, is one foot nine inches thick; C, the parrot-coal, of variable thickness; the average is about four feet; there are two inches of soft parrot-coal in it; D, the upper blind-coal, one foot nine inches thick; and E, the lower blind-coal, two feet eight inches thick, with two inches of fire-clay near the bottom of it. There are several other coals under these, which I have got no account of. These coals are bounded, or rather cut off, on the east and west by the trap-dykes Nos. 1 and 3; they bear and dip as shewn on the map. The dip is quite contrary to the neighbouring strata, and the regular dip of the country. They appear to have been lifted up into their present position during the evolution of the adjoining trap-rocks; for on each side of the trap-dykes within which they lie, the strata dip toward them. But there are more evidences of this; for although only one fault, No. 2, is represented in the map, yet between that and trap-dyke No. 1. the coals are lifted up and down by six or seven faults, none of them exceeding three or four feet. Such working up and down of the strata, I should think, clearly indicates mechanical violence. Beyond fault, No. 2, (which has been recently wrought), I have not succeeded in getting a description of the slips and fractures met with; but I understand generally, they are of frequent occurrence. The two ends of the semicircle dip at a greater angle than the centre, as if each end had been thrown up, and the strata broken over at the fault No. 2, thereby producing the curved line of bearing. The blind-coals D and E have not been shifted. On the west end of the curve they are flat and undulating, and I see from an old paper that they often "trough." From all these circumstances, and the fact that some of the coals are deprived of their bitumen, it is reasonable to conclude, that the Burnturk coals have been upset by the upbearing of the adjoining

Igneous rocks. Some additional facts corroborative of this will appear, when we describe the neighbouring strata. There is a quarry of greenstone above these coals; the bed is about fourteen feet thick, and lying between sandstone; the upper point of contact is well seen. The greenstone gradually assumes the appearance of the sandstone, and the sandstone that of the greenstone, in such a manner, that a specimen at the point of transition could not be distinguished; the sandstone is much hardened and changed; the trap has flowed in without disturbance, and I suppose it to have come from the trap-dyke No. 3.

3. Fother, Cults, and Clatto Limestones and Coals.—The Cults limestones consist of three workable beds, A, B, and C (map.) But in order to give a distinct idea of the stratification, I subjoin a section. I may remark, however, that considerable variation of thickness occurs at different places of the quarries. The following is the average of three sections.

*Section of strata connected with the carboniferous limestone,
Section 4th, Plate VII.*

No.		ROCKS.			LIMESTONE.		COAL.	
		Yds.	Feet.		Feet.	In.	Feet.	In.
1.	Limestone,	...			5	0	...	
2.	Sandstone and shale,	16	2		...		...
3.	A, Coal,	...			...		1	2
4.	Shale,	1	0		...		...
5.	Sandstone. This is sometimes so calcareous as to be termed a limestone,	1	0		...		...
6.	B, Coal,	...			...		1	0
7.	Shale, with a few thin beds of iron-stone,	5	1		...		...
8.	"Sklut," at one part of the quarry. This is entirely composed of shells crushed; they are very like the Modiola figured by Parkinson. This bed contains most of the organic remains,	2	2		...		...
9.	B, Limestone,	...			14	0	...	
Carried forward,								

	ROCKS.		LIMESTONES.		COALS.	
	Yds.	Ft.	Feet.	In.	Feet.	In.
Brought forward,						
10. Shale with three inches of coal,	2	1	...	...
11. Sandstone,	4	0	...	...
12. Soft friable shale,	1	2	...	...
13. C, Coal,	...	...	...	...	1	6
14. Shistose sandstone,	1	2	...	...
15. A, Boulder limestone,	...	...	8	6	...	
16. Sandstone,	3	1	...	...
17. D, Coal,	...	...	...	...	1	0
18. Sandstone,	2	2	...	...
19. Shale,	1	2	...	...
20. E, Coal,	...	...	...	...	0	10
	42	0	27	6	5	6

This is the last coal under the limestone, and many searches have been made in vain to the north of this. Under it the argillaceous beds gradually diminished in thickness and number, and the whole plain of Stratheden, northward to the next range of trap hills, is one uniform mass of sandstone, almost destitute of organic remains. The limestone C is of a dark bluish-grey colour, and compact: it is reckoned inferior to the thick bed, and is very seldom wrought, so that I had some difficulty in obtaining a specimen, and no opportunity of searching for organic remains. In the hand specimen in my possession, I observe the remains of minute organized beings, which, although not so small as the Entomostraca of Burdighouse, require the aid of a microscope to examine them. Limestone B is so like the bed I have so often described in other parts of Fife, that I need not repeat it; it is here fourteen feet thick. At some places of these extensive quarries, organic remains are rare in the limestone itself; but at other places they are plentiful. I obtained here the *Terebratula*, *Belerophon*, *Producta*, *Encrinites*, and *Corallines*, but not in abundance. The Boulden limestone A is stratified in beds of from three to eight inches thick; it abounds with organic remains, but none of them perfect. I can trace the *Producta*,

Terebratula, and Spirifer only. One of the beds is a madre-pore limestone, and contains abundance of Encrinites. The coals are all too thin to work, and do not merit particular notice. But, above the section given in the preceding page, there is a coal said to extend along by the dotted line E. It is little known. I have heard that there is another seam here, and that the one is four, and the other two feet thick. There is appearance of old coal-workings at many places parallel to the limestone, even among the trap. These strata of thin coals and limestone commence at trap-dyke No. 3, and bear round, forming a portion of a circle, as seen on the map, until they meet with dyke No. 4, which shifts the strata up to the east about eight yards. The strata wave up and down in curves, close up to it, and the limestone is destroyed on each side of it for a few yards. The vertical dyke itself is not trap, but dolomitic limestone much altered. Beyond this they extend, and are wrought as far as the farm of Skelpie, a distance of about a mile and a half, in which there is no interruption worth noticing; the limestone, however, sometimes increases in thickness to twenty feet; such portions are named Rumbs by the workmen, and are generally of inferior quality. Section 4th shews the dip of these beds; and as limestones and some coals are found at Clatto, dipping north-east, I am inclined to suppose that they are those above the limestone lifted upwards, as represented on the section 4th, Plate VII. by the adjoining trap. I have no proofs to offer on this head, as there are no means of identifying the strata, the quarries and pits being shut up long ago. From what I know of the country, I cannot see how any limestone can be there, except it be thrown up from beneath by trap; this, added to the fact, that these coals are much fractured, and sometimes deprived of their bitumen, has led me to this conclusion. These Clatto coals bear and dip as represented on the map. The upper seam is said to be two feet thick, and the lower one three feet.

Other coals have been found under these two, but thin, blind, and not worth the working. One of the faults shewn on the map, shifts the strata about four yards down to the north, and the other is a sandstone dyke.

It is thought that the Burnturk coals are the same as those above the limestone, and this supposition is strengthened by the fact, that limestone has been wrought at Annfield, and was found dipping away under the Burnturk coals; but until the Annfield quarries are opened out, and farther explored, this point cannot be *positively* determined. It seems highly probable, however, as the Cults quarries occupy a much higher level, and may therefore have been productive at dyke No. 3, and lifted up, at the same time that the Burnturk coals were upset by the eruption of trap there noticed. The next place at which the carboniferous limestone appears, is at the Fother Quarries, about a mile west from Burnturk, at fault No. 1, *b*, from whence it trains round, as seen on the map, until it reaches the trap-dyke No. 2, *b*, which alters and destroys the limestone on each side of it. It appears as if the strata had sunk down at the point where this dyke intersects it, and has thus produced the curved line of bearing. The limestone has been wrought nearly as far as Nottingham, but what stopped the operations there I have not been able to ascertain. The thickness of the stone and superincumbent strata are very similar to those at Cults. The upper limestone has been seen here, but the "Boulden" bed has not been got, although there can be little doubt it is here, and would be found if sought for. The limestone is here of a darker grey colour, and more crystalline in its structure. Organic remains are more plentiful here in the rock than in the "sklut;" terebratula are very common, and great numbers of small microscopic shells are also found.—I have now gone over all the coals and limestones that are known, and I believe have not omitted any explored or known part of any consequence within the limits

of my survey, and shall now endeavour to trace the general line of this limestone, containing marine shells, and under which no workable coal has been found.

General Course of the Carboniferous Limestone.—The course of this limestone, always so important an object in the geology of a country, is not so uninterrupted as could be wished. I hope, however, that I have succeeded in pointing out its localities so often, that no difficulty will be felt in understanding its general line. It is known on the west side of the basin under the lowermost coal of last year's survey. It is there seen at Seafield, at Tyrie, and Innertiel, and afterwards at Chapel. From this point all the way north to the Lomonds, a distance of seven miles, it has not been seen.* From the Lomonds, proceeding eastward, it is not again known until we reach the Fother Lime-quarries. The next point, where it is certain, is the long range of the Cults Quarries, but limestone has been wrought at Annfield, which in a manner fills up the gap between Cults and Fother. From the east end of the Cults Quarries, at Skelpie, the country is covered with trap, and the limestone is next seen at Fleece-faulds and Tequhats, almost two miles out of its regular line of bearing; so much is it out of its course, that I could not believe it to be the same limestone, and therefore made diligent, but unsuccessful, search for it farther north. When we consider the immense extent of shift which has been frequently proved to exist in this coal-field, it is no longer unphilosophical to believe, that a combination of faults has shifted this limestone over to Tequhats. From this place its course is distinct upon the map as far as Ceres, and after that it stretches on by Ladedda, Wilkieston, Winthank, and

* It must be gratifying to geologists to learn, that the course of this limestone has been carefully examined, to the westward, from both these points, a description of which will soon be before the public, from the pen of a talented writer.

Mount Melville. Its further eastward course has yet to be explored. On the east side of the basin it is at Pittenweem, and is known to be wrought at various places inland, which have not been surveyed. It therefore appears, that, from the Lomonds, one side of a long elliptical basin is distinctly traced eastward to Mount Melville, the extreme end of the basin being yet unexplored, and the other edge of it coming to the sea at Pittenweem; and within these lines the whole of the east of Fife coal-field is included, if we except the few thin and useless seams noticed under the limestone at Pittenweem and Cults. This course, as the reader must have observed, is very much interrupted and broken, by the various faults and dykes which have been pointed out.

Besides the limestone containing marine shells, there is another limestone included among the coal strata, which, for convenience, we shall term the Upper Limestone. Its course is by no means so distinct as the carboniferous beds, but a glance at the map will shew that the north crop (at least the place where we are to look for it) is covered by trap. Its course is traced for a considerable distance on the south-east crop, under the division of Balcarres coals and limestones. On the north crop, it is noted at the following places, first, in my survey of last year, situated between the Dysart and Dunnikier seams; and this year at Pilmer and Thomsford, and I should think the limestone at Radernie and Lathockar, is the upper limestone broken up and scattered about by the eruptions of trap. It contains very few organic remains except microscopic shells. I have had but few opportunities, however, of making an effectual search for them, as the limestone is of inferior quality, and not many quarries of it open. There are various thin calcareous beds noticed in the different sections of strata, but as they are unworkable, no extensive line of them can be traced.

Organic Remains.—Vegetable organic remains occur in

the greatest profusion and variety. No shaft is sunk nor mine driven without thousands of them being exposed. The richest deposits of them are the softer bituminous shales, so exceedingly friable, however, that they can only be studied on the roofs of the mines. They will seldom bear taking down, and when the attempt is successful, exposure to the atmosphere very soon crumbles them to pieces. They are also tolerably abundant in the harder shales and slate-clays, which keep much better. The sandstone contains no delicate impressions of the smaller leaves and plants, but abounds with cacti and large trees, the bark of which is converted into a clear, bituminous coal, which enables us to detach them very easily. They are found in all positions, but the most common is the perpendicular, and they seldom occur with branches, although the marks of them are sometimes perceptible. The swelled out part of the root and short pieces of its ramifications, are sometimes found resting upon coal. These trees are almost always composed of fine-grained sandstone, although passing through thick beds of shale, and when they proceed through various alternations, the tree partakes distinctly of the lines of stratification through which it passes, and can be got only in pieces of the same thickness as the different beds. Although thus stratified, they are invariably composed of fine-grained sandstone, but inclosed in a matrix of shale. They seldom extend far up, being cut off by the first thin seam of coal or other carbonaceous bed, above which they are seldom again found. And when no such interruption occurs, they often terminate abruptly, and are never again seen. In sinking a large shaft, where there was plenty of room to save any thing of that kind, the end of a fossil-tree, about twenty inches in diameter, was discovered, apparently a very perfect specimen, and in such a situation as to be got through all its length, it being perpendicular. This I intended to accompany the present paper, and had

given particular instructions that every "lith" of it should be saved. For some days layer after layer came up, and I flattered myself I had found one as large as the celebrated Craigleith tree, and in such detached cylinders that it could be easily transported and built up at any convenient place. After two feet had been obtained, it assumed an irregular oval appearance, and in another foot it terminated as abruptly as it began, and although forty yards more had been sunk, no further trace of it was visible. There is another singular circumstance connected with some of these fossil trees, which is, that they sometimes contain impressions of plants within them. It is most difficult to conceive how they got there.—I have no means of naming the varieties of these fossils. The following plants which I have found (some of which I herewith transmit to the Society), have been named, after comparing them with the engravings of Professor Lindley and Mr Hutton's beautiful work, the "Fossil Flora of Great Britain." I have found species, however, which are not figured in that work.

List of Vegetable Remains.—*Sphenopteris bifida*, *affinis*, *dilatata*, *adiantoides*, *multifida*, *caudata*, *crenata* (only a detached portion). *Lepidodendron Sternbergii*, *gracile*, *selaginoides*, *elegans*. *Sigillaria pachiderma*, *organum*, *reniformis*. *Calamites approximatus*, *cornuformis*, *nodosus*, *Mougeotii*. *Pecopteris Mantelli*, *adiantoides*, *repanda*, *laciniata*, *beterophylla*. *Neuropteris gigantea*, *Loshii*. *Adinopteris obtusa*. *Asterophyllites equisetiformis*, *jubata*, *longifolia*, *palliodes*, *dubia*. *Farularia tessellata*. *Sphenophyllum crassum*, *Schlotheimii*. *Stigmaria ficoides*. *Mæggerathia flabelata*. *Lepidastrobis variabilis*. Many of these fossil plants are in such a state of preservation, that they rival the finest engravings. Some of the slabs which I have sent contain detached portions of many of this list, mixed up with other leaves in such a way that it is almost impossible to name

them. I have obtained *leaves* of delicate flowers, not the impression, but the real leaf. One of them in hard bituminous shale, seems like a recent rose-leaf. The shale is black, while the leaf is of a dirty yellow colour, and ruffled up, so as a needle can be placed under it. The impressed side has a small piece of the yellow leaf adhering to it, and there is a corresponding want in the leaf itself: it is the tearing off of this that has ruffled it. Many of the gramineæ are not mere impressions, but have a substance that can be handled, and have likewise a degree of flexibility.

I have not found many shells in the coal-field. Three thin beds of ironstone under the "Barne Craig" coal (No. 4. of last year's paper) contain Glycomeras, Trigonellites, and fish-teeth. About three yards under the above there is a thin bed of shells in a matrix of shale, consisting of the *Unio mytilus* and *Trigonellites*. I have also found shells of the *Terebratula* and *Venus solida*. These names are obtained by comparing the fossils with the figures in "Parkinson's Organic Remains," as are also all the other shells I have noticed in this survey. I have never found a distinct impression of a fish. I have lately found a few scales and teeth in a complete state of preservation; and as I have no means of ascertaining the species they belonged to, I have prefixed sketches of the more remarkable ones, and should they be thought uncommon, I will be happy to send them to any scientific individual who may wish to examine them. I have never seen nor heard of any thing like them in the coal formation.—One of the small teeth is remarkably like some of the *Burdiehouse* teeth figured in Dr Hibbert's interesting memoir; and one large scale, not figured here, is *exactly* like Fig. 8 of his second plate. The two represented in the accompanying figure 6th are the most singular: they seem to be almost the same. The twelve small points are brightly enamelled, as well as the ridge *a a*. All the rest is black and without lustre, the

colour of the points is deep brown, gradually acquiring a blacker shade as it comes to *a a*.

FIG. 6.

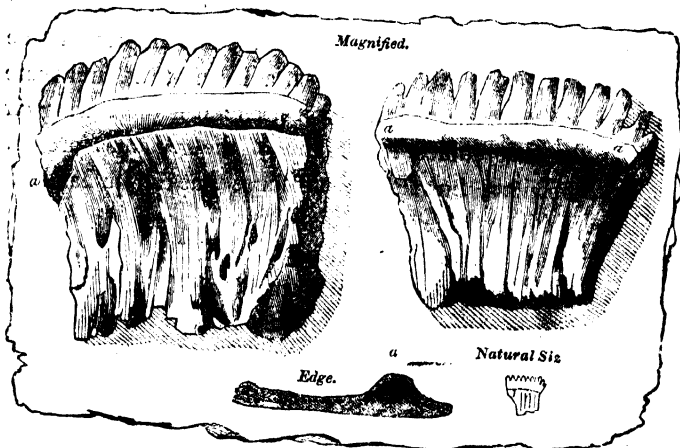


FIG. 7.

Natural Size.



FIG. 8

Magnified.



Fig. 7. is of a deep blackish-brown colour: it is striated, but not parallel with the tooth; the cross over the bend of the

teeth in straight lines, as seen on the sketch ; one of them was composed of pyrites, in a matrix of black bituminous slate.

Fig. 8. is very perfect, and as sharp as the point of a needle ; the striæ are parallel with the tooth ; the colour is not so dark as the former.—This little tooth is detached from the slab, and is very strong. The workman who found it had it stuck in a piece of coarse paper, and carried about for some days without injury.

FIG. 9.
Magnified.



FIG. 10.

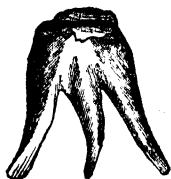


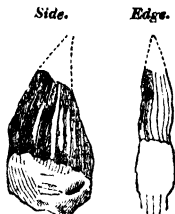
Fig. 9. is a very singular small tooth, when viewed with the microscope : the three prongs very much resemble a fresh drawn human tooth, with little points of flesh adhering to it. I have only found three specimens, and it is impossible to get them out entire, and the view of them in the slab is not satisfactory, the edge of the little cap *a* only being seen. I have only the cap in a separate form, the other specimens are like the figure 10. Fig. 11. is an isometrical view which will shew the shape of the top of it.

FIG. 11.
Magnified.



Natural Size.

FIG. 12.
Side. Edge.



Natural Size.

Fig 12. is sketched the natural size, it is flat and striated,

but not enamelled. I have also found coprolites, containing small teeth, and undigested scales of fish. All these curious relics have been found in a stratum of black bituminous slate: there are more than I have figured. The coprolitic matter is always found at one particular part of the slate, where there is a thin irregular bed of ironstone, the broken teeth and other fecal matter are attached firmly to the upper side of this ironstone, spread out, occupying sometimes an area of a foot, and sometimes less. I regret that I have it not in my power to sketch the two best ones, which were lent to a gentleman in Edinburgh, who has mislaid them: if ever he shall find them, sketches of them shall be forwarded to the Society. I noticed in passing, the different shells I met with in the limestones, but will here give a list of all that I have seen in the carboniferous limestone.

Organic Remains in the Limestone.—Encrinites, Coralines, abundant; Producta, Producta spinosus, plentiful; Spirifer, Terebratula, plentiful; Bellerophon, Orthoceratites, scarce; Madreporas and microscopic shells plentiful; teeth and scales of fish, scarce. There is also a bed of shells, like the modiola figured by Parkinson, but as these shells are much crushed, I may be mistaken.

This small list of organic remains may not be nearly all that are found within the district of survey; they are only what I have collected myself, and it is but recently that I have turned my attention to the subject, and there is no other collection to which I can refer.

VI. *Trap-Rocks.*—I shall under this head notice generally all those as they appear on the map, and only such parts as have not been described in connexion with the coal strata which throw more light upon the effects produced by them than mere outward observation can furnish; and this part of the subject will necessarily be more speculative than what we have already described. These rocks occur in three

distinct forms of position. 1st, As ejected masses protruded through the broken edges of sedimentary strata; 2d, As dykes traversing and intersecting the country; 3d, As overlying masses resting unconformably on other rocks; and, lastly, As beds interstratified with some of the members of the coal formation. The last is the most rare position. I have only five examples to offer in all my survey, and all of so limited extent, that it is easy to trace them to their source. Fife has been pointed out as affording many such examples, but there are but few in the district I have surveyed. The celebrated rocks between the carboniferous limestone and Kinghorn were so run after during the geological war, that all the geologists of Europe have heard of them, and I believe they are figured in some of the continental works. Like religious zealots, each sect laid hold of the text that best suited their own peculiar views, and these rocks long continued to be the stronghold of the Neptunists. Another such section occurs in the same geological position, viz. at Durie Den, where various alternations of trap and sedimentary rocks are well exposed.

The examples within my district have all been noticed as we passed. They are at Athernie dyke, page 274; at the Bungs saddle back, page 306; among the Balcarres coals at page 301; at Burnturk, page 327; and at Tyrie, page 268; all of which are of limited extent, and can be traced (except the latter) to their source. Beginning at the west end of the map, we first come to that mass of trap extending from Nottingham to the Burnturk coals. It occupies the high ground, and is known to be overlying at Fother lime-quarries, and is ejected between Burnturk and Rameldrie Mill. The narrow strip crossing over to the next large piece is said to cover the blind coals. The next mass appears to have been ejected about the hills of Bedes Craigs and Clatto. Between these hills and the Cults lime-quarries it is proved to be overlying, and all along by Skelpie farm it is thought to cover coals.

At Auchtermarnie Mains it is protruded (see figure 4, page 324) ; at Whaley Den and Kilmux it has the appearance of an ejected mass. It is seen to be overlying at Smithy Green ; but I should think the neighbouring hill of Pratis has been ejected, from the appearance of the strata adjoining. From this eminence, which is composed of large granular greenstone, the large fissure or dyke No. 2*a* proceeds, as described among the Cairlhurlie coals, (page 312). The next triangular piece, from Kains to Hillteasess and Cassindillo, is all hilly country, and appears to be overlying, except about Wyndygates or Teasess Hill. At the place where the narrow piece is seen crossing the rivulet at Newbigging of Craighall, it is overlying and the line of junction seen. The strata are indurated and each rock gradually loses its ordinary appearance, so that the exact line where they meet cannot be identified.

Near Cassindillo, where the trap crosses the brook, it has the appearance of having been thrust upwards, the adjoining sandstone and shale are altered, convulsed, and almost vertical. It is here of the large granular greenstone variety, rather porphyritic in its structure, and having a remarkably granitoid appearance ; it is very hard, and disposed in irregular columns or vertical beds. The stream at this point has worn a deep chasm for itself, and if we may judge by the hardness of the rock, many ages must have elapsed before so trivial a cause could have produced so great an effect. There are no means of ascertaining correctly if any of the trap extending from this point by Craigrothie to Tarvit Tower and Skelpie has been ejected or not. At all the places where the junction is seen it is overlying. The hill on which Tarvit Tower stands is capped with trap, and its western slope is sandstone. The trap at Ceres is ejected as explained (see section 8th, Plate VII). Ladedda and Drumcarro hills have also been ejected (see pages 320 and 321) ; and some of the adjoining trap is an overflow from that source. Of the trap covering the elevated ground from Wilkieston to Newbigging of Craighall, nothing

can be said ; it is covered on all sides by grass, the craggy tops only being visible, which are composed of large, fine-sided columns of basalt, that separate into thin portions from twelve to eighteen inches thick. The west end of these craigs have a very beautiful appearance. The trap at Lawhead appears to be ejected, as also that piece extending from West Lathones to Bowhill (see sect. 9th, Plate VII.) by Cumberland. The high land from New Guilston to Dunnikier Law is covered with overlying basalt, and it is impossible to say whether any protrusion occurs between Dunnikier Law and Coates Hill, or between New Guilston and Largo Law, which is the most striking of all the trap-hills in the district. An outline of this hill is to be seen on section 4th, Plate VII. as it appears from the south ; and in section 5th, Plate IX. a sectional representation of it from the west. It is about 910 feet above the level of the sea, and the west and north-west slopes of it are composed of sandstone ; and where it is exposed in the quarry represented about half way up, it is distorted and broken in an extraordinary manner. The slopes of sandstone are smooth and uniform in their outline, while the basalt assumes all the characteristics of the trap-rocks, having bold projecting crags and terraces standing up perpendicularly. Above the sandstone where the cone is smooth in its outline, a few inches of soil consisting of decomposed trap covers the basalt. The summit is cleft in two, irresistibly suggesting the idea of a crater, the integrity of which has been partially destroyed by the great westerly current. At the very summit, most regularly beautiful columns of basalt present themselves. They are covered with grey lichens, are about seven inches diameter, five sided, and composed of compact black basalt, so hard and flinty, that it is difficult to detach a specimen. At the cleft of the hill a soft, dull, red-coloured tuffa is found occupying fissures, and enclosed among the columns. The south side of the hill is composed of basalt. All the way down to its base it is very precipitous (see section 5th, Plate IX.) The

east side of the hill is sloped very gradually, and consists of soft tuffa and debris, except the eminence of Hallhill Craig, which is composed of the same kind of basalt as the summit, disposed in columns, inclined north at an angle of about fifty degrees, but at the east end they are nearly horizontal. The regular dip of the strata at the foot of the hill on the west side should have been towards the centre of the great basin, instead of which we find it in the opposite direction, and sloping up the hill. On the sea-beach we also find the mass of strata which contains the Strathearny coals (opposite Largo Law on the south) thrown up from its inclined position, and the coals bearing round the base of the hill. All these circumstances, together with the fractured state of the sandstone, clearly shew that the trap has burst forth violently at this point, and in its passage upwards carried the surrounding strata with it. The eruption has affected the dip as far as the Thomsford line basin, which is the point at which the dip has been bent. This hill also exhibits some striking marks of having been formed under water flowing from the west. The reader will refer to section 5th, and again observe its outline. The high ground at Tequhats slopes gradually down to Balmain Mill, where the north slope of Largo Law begins to take its rise. The valley of Balmain Mill (a name which I adopt for convenience) does not extend above half a mile west, when the country again rises.

This high ground had interrupted the current, and protected the sandstone on the north slope, while we find the south slope degraded, and worn nearly perpendicular into the solid basalt, there being nothing to protect it from the rush of waters, whose violent action must have been increased by not getting vent by the north. Again, in the valley a little to the east of Balmain Mill we find thick beds of soft tuffa and wacke (into which a deep *alluvial* chasm has been cut); while on the south the basalt is worn bare at every place by causes not now in action. If this hill has not been formed under

water with a current from about west, why did the soft materials which had flowed down the north slope and remained at the base, not take the easier course, and fall over the almost perpendicular south side? Because the softer volcanic matter had found no rest on that side for the current; and accordingly we find it scattered over the plain to the eastward as far as Johnston's Mill; while on the north it had rolled into a protected valley of smooth water. These facts, which I may have failed to render interesting on paper, are yet very striking when examined on the spot. But if additional evidence were wanting of diluvial agency, the east and west section exhibits still more imposing features (see section 4th, Plate VII). On the west slope there is a smooth acclivity of sandstone half way up the hill, which is worn lower than the basalt, and swept smooth and clean; while the eastern side is covered and filled up to a considerable height with tuffa, imbedded water-worn blocks and gravel, giving the hill a tame appearance when approached from the east. This eastern slope, although still occupying a high level, bears marks of having been higher at one period. The picturesque rock of Hallhill Craig I consider to be a portion of a stream of lava which had been compelled to flow east by the action of the current; that each side of this basalt had been filled with softer volcanic matter and all sorts of debris, and that after the refrigeration of the trap, the continued action of a former sea had broken in the crater (which would be the weakest point), and produced the cleft now seen. The water being thus admitted to the deposit of debris behind the hill, had scooped out a valley opposite the cleft, and left nothing in its course except the very hard basalt of Hallhill Craig, which also bears marks of abrasion. This cutting of the east slope opposite the cleft gives us the very direction of the ancient current, which must have flowed from a point a little to the north of west.

All the eminences within the bounds of this survey exhibit the "Craig and Tail;" the western points are bare, and often

bold and precipitous ; while the long sloping " Tail " eastward is invariably covered to a considerable depth with sand, gravel, and water-worn boulders. I could adduce many good examples of this, but in a paper of this kind, they would be out of place. In section 4th, Plate VIII, I have represented Coates Hill as ejected. I have been led to infer this to be the case, from the disrupted state of the strata at all the places where its base is seen. At Balchrystie three seams of coal were found in making a cut for the tail cut of a thrashing mill, which were lying irregularly and in a distorted state ; the crop of a coal cast from Rires Farm was also irregular ; and lastly the elevation of the circular end of the Rires coal-basin, all tend to prove that another eruption of trap must have taken place about this hill. The trap occupying the country to the east of this has been noticed in describing the Balcarres coals and limestone (page 299), and the Largoward and Bung's coals (page 306), where it was seen that eruptions had taken place at Kilbrackmont Knock, at Bung's Hill, and Kellie Law ; and it is presumed that the rest is overlying.

The trap-rocks on the coast were treated of in describing the coast, section 1st, Plate VI. We shall now take a general view of the faults and dykes we have passed over, as they are in a manner connected with the rocks we have been describing.

General View of the Faults and Dykes.—Faults are the fractures at which the strata have been broken. In almost every case they follow the singular (and difficult to be explained) law, so often described by geologists, viz. if the fault throw up, the dip and rise of it form an obtuse angle with the plane of the beds ; and if it throw down, the reverse is found to take place. With large slips I have never seen an example contrary to this. The sides or walls of faults are often polished or glazed over with argillaceous matter, and are sometimes mixed with pounded coal, as if the surfaces had rubbed hard against each other, during the process of

shifting. The black matter is termed the "veeze of the coal," and is a good mark to follow in search of the shifted stratum. In faults which throw up or down a great distance, "no veeze" is seen except in the vicinity of the coal, which seems to imply that the pounded coal produced by the fracture was not enough to cover the surface of a deep fault. Other faults separate, and the fissure is filled up with heterogeneous materials from the surrounding strata, and often with clay and gravel. In such cases there is no "veeze." The coal and all the other minerals are always more or less spoiled in the neighbourhood of the smallest fault. Trap-dykes are fissures filled with igneous matter, and almost all the varieties of trap are found in them; the most common, however, is basalt or greenstone. In this district such dykes are always in the vicinity of masses of trap.*

Faults have been compared to a broken sheet of ice again frozen, the new ice representing the faults and dykes. This ingenious simile does not hold good in Fife. While they exhibit waving lines and cross shoots, they have all a general line of bearing, and a degree of parallelism. On the west side of the basin they point generally to the Bass Rock, and

* In examining all the large faults met with, it is found that the coal is altered in quality and thickness on each side of them, and the distances between the seams often increased or diminished. It is impossible that these differences could be brought about by the mechanical action of the convulsion. It appears to me that the cause is this, viz. It is very common to find seams of coal and other strata to be of irregular thicknesses along their line of bearing, and also in a crop and dip direction. Now suppose coals to get thinner to the dip (by the greater compression), a great slip throwing them up has the effect of raising the compressed and thinner strata nearer the surface, and opposite the other or crop portion. Thus at page 296, the Kellie "fore coal" was thirteen feet thick before it came to the 180 yard fault, No. 2., and where it was found beyond it, it was only five feet thick; the thrown up thick portion being subsequently abraded off by the diluvial waters. If this theory is correct, it should be found in most cases, that at faults thrown up considerably, the coal will be thinner and harder on the upraised side of them.

on the east to the Island of May. A look at the map will shew how they range. They all form an acute angle with the hilly country occupied by the trap, and bear towards it somewhat in the same manner as the brooks upon a map of a gently sloping country, bear slanting towards the valley. I have shewn only a very few of those that are known in explored districts. They are *innumerable*, and with one exception* all the large ones throw *up to the north*, and point out to us in the most decisive manner, the very steps by which the country has been raised to its present level. An examination of section 3d Plate VIII. will better elucidate the matter. This section commences at the lowest point of the main seam workings at Wemyss, (and for the sake of distinctness I have not introduced any of the seams below the main coal). The line of the section follows the line of bearing as near as possible. The first trouble met with is the nip out C, of rare occurrence, and as no trace of violence is visible, I should think it must have originated at a period antecedent to the date of the faults. The coals here gradually thin out to a point, and become of a stony nature. All the seams do not meet with it at the same place, some extending farther than others, the extent destitute of coal being about half a mile. Some special cause must have operated here, during the deposition of the coal strata;—probably the entrance of a rapid river into the estuary or lake into which the strata were depositing, and which had prevented the resting of the lighter vegetable matter. The first fault E throws up sixty-four yards; F forty-four yards; and G 200 yards. From the circumstance of my not being able to identify the next three Lundie coals, it is impossible for me to say how much the trap-dyke H shifts. Fault No. 1. shifts about seventy yards, the Cairlhurlie dyke No. 2. *a*, does not alter the level of the strata: the

* Dyke No. 4. at Earlsferry which throws *down* to the north. But we are to keep in mind that this is surrounded on *all* sides by trap, which accounts for its want of uniformity with the other.

sectional line now passes over the centre-dip of the Cairlur-lie coals, and the extent of fault No. 3. *a*, is not known. Trap-dyke No. 4. *a*, also cannot be ascertained. The country has now attained its greatest elevation, and no more large faults are found; the small fault No. 5. *a*, shifts four yards, and No. 6. *a*, only shifts ten feet, and the last one No. 7. *a*, Plate IX. shifts twenty yards. Now we have here from the sea to Norries Law, a known extent of throw up to the north of 388 yards; while the height of the country itself is only about 200 yards. The question naturally arises, Why is the country not as high as is represented by the steps of fracture? What has become of the successive terraces which had been thrown up? Are there no remains of such extensive changes visible above ground? The general answer would seem to be,—that as the upbearing took place under a water current, each successive ridge as it was thrown up, had had its sharp top abraded; and that the long continued action of the ancient sea had gradually smoothed over and reduced the high lands, and scooped out the valleys into their present agreeable forms, leaving only a few monuments that require careful and patient investigation to bring the truth to light. Such are some of the trap-hills, and those capped with that rock, which being more hard and durable in their nature, had longer resisted the destructive force of the current. These cappings of trap have preserved sandstone at a much higher elevation than it can be found where it has been without protection, in the fair way of the current. Thus, at Dunnikier Law, under the basalt, we have the most tender and friable members of the coal formation preserved at a height of more than 300 yards above the level of the sea. Again, such perpendicular ridges of sandstone, shale, and coal as would be thrown up at the faults, could not possibly resist the abrading effects of a water current. In proof of this we have only to consult the diluvial heaps, and we will find the greater part of them to consist of abraded materials, not the least remarkable of which

are the layers of coal-gravel dust. I have found a bed of such coal-gravel interstratified with loose sand on the top of the trap on Tarvit Hill. We accordingly find the upheaved ridges smoothed down, and the rock very near the surface, and, what is very striking, we find the other side filled up with gravel to a considerable depth. Thus, on one of the sides of the trap-dyke at Balbirnie, 100 yards of gravel and other debris were found; and in the neighbourhood of fault F at Kirkland, a depth of seventy feet of sand and gravel occurred. It thus appears that the current had assisted in two ways to obliterate the appearance of fracture, first by lodging sand and gravel on the one side of the terrace, and by abrading the most abrupt part off the ridge. The faults represented in section 7th, Plate IX., along the line of the Kellie coals, although eight or nine miles distant, and on the other side of the basin, have a considerable resemblance to the faults last described, although not traced over such an extent of country. The ground here attains the same elevation, the largest fault shifting 180 yards; while the west side of the basin shews one of 200 yards. On the east we have also several trap-dykes (beyond the large fault) then a large ejection of trap, and no more faults of any great extent. Between these two lines of fault we have a piece of country rising to a greater elevation, and accordingly we find the faults at that place (Largoward, see map) exceed the other places both in magnitude and number.

From all these circumstances, the following general inferences may be drawn: That the trap-rocks of Fife all belong to one epoch; that at a period subsequent to the consolidation of the coal strata, the country for a long series of years had been under water, whose current flowed from the west; that the interior had been occupied by trap in a state of fusion, the workings of which had produced the faults and fractures we now see; that after various upheavings, these plutonic rocks burst forth and were gradually refrigerated; and that the remains of such extensive derangements have been subsequently nearly obliterated by the action of the current.

ON PRESERVING POTATOES, AND RAISING THEM FROM SEED.

By SIR G. S. MACKENZIE, BART.

THE Highland Society, always anxious to procure information, has offered a premium for the best and approved account, founded on experience, of the most successful method of preserving potatoes in good condition, in their natural state, for a period of not less than ten months from the time of their being taken up. I hope to be able to give to the Society satisfactory information on the above subject, having paid long and particular attention to the potato, and to state some circumstances which do not appear to be so generally known as I presumed they were until I saw the offer above quoted.

Of various methods I have tried for preserving potatoes from frost, that practised most commonly seems to be the best, viz. : Making a shallow pit about a foot and a half deep, on a dry spot, and heaping the potatoes like a roof to the height of about four feet. On the heap thus formed, straw is laid to the thickness of about eight inches, and over this the earth taken out of the pit, the whole being beaten firm by the back of a spade. Some time about the end of February, or beginning of March, the pit is opened and the potatoes turned over, all the shoots being picked off. I may here remark, that where a few side roots have proceeded from the shoots, I have planted them, and had almost as large a produce as from sets. The mode of planting them is to cut a drill with a spade so deep that the shoots may be covered about two inches. They are laid inclined upwards towards the soil, covered, and another drill made, and so on. The only risk is from frost ; for if once nipt down, their shoots do not recover so readily as those from sets. On this subject I beg to add, that for early potatoes it has long been my practice to spread sets on the floor of a vinery, or on a hot bed in March, with a little sand over them. By the time there is little risk of frost, the shoots are long enough for the sets to be planted out about the middle

of April. I have frequently had the shoots nipt down, but they always recovered ; that is, new shoots sprung up in a very short time, and I never observed that this made any difference in the period of the tubers becoming fit for use. The early potatoes I use are the London early for the first crop ; some of my own, which is a little later, and remarkably mealy for an early potato. After the heap is turned over, as I stated above, it may be again covered, and the potatoes allowed to remain a month longer, after which they should be removed to a barn or shed, and picked. They should now be frequently turned over, and picked free of shoots. If the eyes of a potato are scooped out, it will gradually dry, if properly exposed ; and it may then be scraped into flour though not very white. In this state they will keep for an indefinite time ; and as there is no risk of their becoming mity, as flour does, dried potatoes might be found useful during long voyages, though potato flour is better.

It ought to be made generally known that there are varieties of the potato which, though sufficiently protected from frost, will not keep, *under any management*, for more than a few months. Do what we will they decay, owing to their natural constitution ; other varieties again will keep very long without any trouble. Hence the Society's proper object is not to offer a premium such as the one which has given occasion for the present communication, but to offer one for raising new varieties, and producing one or more with as many as possible of the qualities which a potato is desired to possess. The same observation applies to the keeping of apples and pears, and various fruits and roots. Long keeping is a particular property belonging only to some, and not to all varieties.

Some varieties of the potato are best for the table early in winter, and others are best in spring. Instead of having the trouble to raise different sorts for different seasons, it is best to sow seeds and to procure a number of varieties in this way

for selection. It is now about twenty years since I first began to raise new varieties ; and I will now state my mode of proceeding, that others may follow it if they think fit.

I first noted down the qualities which it was desirable a potato should have. These are, 1. dryness or mealiness ; 2. agreeable taste ; 3. moderate size ; 4. regularity of shape, not having deep eyes ; 5. not bursting when boiled ; 6. not having a tendency to shoot at an early period ; 7. long keeping ; 8. productiveness. Among hundreds of varieties I have not found one possessing *all* of these qualities, but I do not despair.

Having gathered the apples from different varieties, I keep them till spring, when I open them, take out the seeds, and dry them. A piece of ground being prepared by digging in some manure, but sparingly, and the surface being finely raked, the seeds are dropped thinly into shallow drills, two feet asunder. When the plants appear, they are thinned out to eighteen inches in the rows, and I have usually selected the strongest. Those taken out may be transplanted to another spot. As the plants grow, the earth is heaped round them. I have observed that, with some exceptions, those plants which flower the same season, seldom produce tubers. My experience has proved that the produce of the first season is not to be relied on as an indication of future productiveness ; therefore no seedling should be rejected the first year. I recollect a plant that produced but one tuber, about the size of a walnut ; this produced the second year one hundred and twenty tubers of good size ; but this degree of productiveness did not attend succeeding generations. I have observed in general, that rough or scaly skinned potatoes are the driest, and often too the earliest. I plant every tuber produced the first season that is not less than a pea, for should one hit on a good variety, it is then more rapidly increased ; it is but a lottery, and some space of ground must be allotted to the drawing of it. I have had as many as three hundred varieties growing

at once. Of course, each variety must be tallied, and a memorandum kept of every thing connected with each. Each variety should be tested the second year, at the time it is taken up, and again in the spring, and those that are good at both seasons preferred for future trial. Indeed all may be rejected but the one that has the greatest number of the qualities noted. In this way every one may procure, sooner or later, a good variety of potato. It is of the greater importance to procure in this way; for difference of soil, and even perhaps of situation, seems to have singular effects, a fine potato in one soil proving bad in another, and *vice versa*. I have one variety that possesses the 1st, 2d, 4th, 5th, 6th, and 7th qualities, which I have cultivated for about eighteen years, and I have not yet succeeded in raising a better. It seldom, however, yields above twenty bolls an acre, of old Ross-shire measure, the peck being fifty-six pounds. Though there are many sorts more productive, yet this potato keeping very long under the management already described, has brought it into very general use in this quarter. I have had young potatoes of this sort, of tolerable size, at my table along with tubers of the previous year. It is ripe by the middle of September. During the two last seasons, the sets of potatoes decayed in many places. None of my own were affected, but some of my tenants lost large patches. I observed a wire-worm on some of the decayed sets, but whether this worm was the cause of the failure, or the failure of the sets induced the insect, from whose eggs the worm proceeded, to lay them on the set, I could not ascertain. It often happens that effects are regarded as causes in such matters. It is my practice to have the potatoes cut into sets, and spread out to dry during ten days or a fortnight before planting them. This serves to prevent risk of their rotting in the ground. But I have known sets of some varieties rot soon after the appearance of the plant above ground; and others I have taken up sound when the crop was ripe. Thus it is clear that long keeping

does not depend on the *mode* employed to preserve potatoes, but on the natural quality of a variety; and the varieties ought to be increased from seeds until the qualities I have enumerated are found in one, or at least the most important of them. It is the opinion of some that the productiveness of potatoes decreases by long cultivation. I doubt this, at least it has not occurred to my observation. If a variety be planted on a soil different from that in which it has succeeded, it may fail, and I have known this to happen.

On the whole, I conceive that the object of the Society can be best attained by the recommendation to every one interested in the culture of potatoes, to raise new varieties from seeds. Seedlings rejected, I mean the second year's produce, need not be thrown away, but given to cattle or pigs, so that the space occupied by the plants cannot be said to have been misapplied.

Since the above notices were written, extensive and accurate experiments have been made in the garden of the London Horticultural Society, in reference to the question, whether it is best to plant sets or whole potatoes. I had long since found that sets were best. The first set of experiments made seemed, however, in favour of whole potatoes; but I pressed a repetition, and also repeated the experiments myself, and the question has now been finally decided in favour of sets. It might perhaps be of use that a well prepared abstract of the papers in the Horticultural Transactions should be drawn out for the *Quarterly Journal*.* A great deal of nonsense has been published about the remarkable failures of the potato crop in different places. The thing is still a mystery, which may not be cleared up for some time. It appears that early planting gives heavier crops than late planting.

* Such an abstract as is here alluded to could not be more acceptable to the *Quarterly Journal* than from the experienced pen of Sir George Mackenzie.—Ed.

**MEMORANDUM COMMUNICATED BY SIR JOHN HALL, OF
DUNGLASS, BART. REGARDING EXPERIMENTS IN GROW-
ING RYE-GRASS OF DIFFERENT VARIETIES. By Mr
BUIST, Landsteward at Dunglass.**

IN the beginning of May 1834 we were directed by Sir John Hall to make experiments with ryegrass seeds of different sorts. The gardens at Whitehall were pointed out as a place well suited for the purpose. Seeds of the following varieties of grass were ordered from Messrs Lawson and Sons, Edinburgh, viz. Italian ryegrass, Stickney's ryegrass, and *Cynosurus cristatus*. They were all put into the ground on the 3d day of May; on the 13th of the month the Italian ryegrass was above ground, and shewed a beautiful braird; on the 16th Stickney's ryegrass shewed itself, but neither so healthy nor so strong; and about the 20th the *Cynosurus cristatus* came up, but with a very sickly appearance. A little common ryegrass was sown at the same time; it did not vegetate so early as the Italian, nor was it so strong, but was decidedly superior to the other two varieties. We expected to be able to save the seed of the Italian of that year, for the purpose of making a fourth trial with the Common Perennial Ryegrass, but, after getting it cut and stooked, we lost it, owing to the heavy rains which took place in the September of that year. All the different grasses were closely mown for the purpose of giving a fair chance another season, as none of the kinds had got the length of bearing seed that year.

In the beginning of spring 1835, the Italian ryegrass took a decided lead of the others, and by the end of April it had the appearance of a strong crop of oats before getting into ear: by the middle of July it was cut and thrashed, giving a return of fifty-seven and a half pounds of excellent seed from about one-eighth part of an English acre. The others were cut at the same time. There was not above half the bulk in hay, and

the seeds of Stickney's and *Cynosurus cristatus*, when put together, did not weigh so much as the Italian. In less than a month the second crop of Italian Ryegrass had grown nearly a foot in length, and on the 29th of September we cut it for the purpose of saving the seed, and had a return of thirteen and a half pounds from the same ground. Since the first cutting of the other varieties they have made no further progress, but have the appearance of a closely eaten pasture, although the situation upon which they grow is equally favourable to vegetation.

[The Silver Medal was awarded to Mr Gray for the following communication.]

ACCOUNT OF THE MODE OF PLANTING PRACTISED ON THE
PROPERTY OF THE MERCHANT MAIDEN HOSPITAL OF
EDINBURGH, IN THE NORTH-EAST COAST OF SCOTLAND.
By Mr RODERICK GRAY, Peterhead. Communicated
by ROBERT JOHNSTON, Esq. Edinburgh.

It is evident that, in former times, a great extent of Buchan had been covered with wood—the remains of which are found in great abundance in the extensive mosses in that district. Remains of the following species most prevail, oak, elm, birch, alder, and hazel; no fir being found in these bogs.

About ten miles from the coast, wood, to a moderate extent, has been reared, perhaps past the memory of man; and, within the last thirty years, small clumps have been planted nearer to the sea with considerable success, although the progress they make is very slow.

Along the east coast of Buchan, especially that part of it which lies flat and very little elevated above the level of the sea, and projecting into the German Ocean, it has been generally supposed that wood cannot be reared with success.

Many attempts have been made, which have ended in disappointment. More success now attends such experiments.

These appear to be the causes which operate against plantations on this coast. Exposure to the east and north-easterly blasts—the little elevation above the level of the sea, the saline particles of which are carried to a considerable distance, and rest upon and destroy the tender leaves of the young wood—in many situations the ferruginous incrustation between the soil and subsoil, provincially called *pan*, varying in thickness from an eighth part of an inch to six inches, and, in some cases, to more than a foot, renders the roots of young trees sickly, which have not sufficient vigour to penetrate into the subsoil, which supplies their permanent nourishment—before draining was carried to its present extent, young trees were injured by the mildews arising from bogs.

The following expedients appear calculated to render less formidable the above causes, which operate against the rearing of plantations. 1st, To protect the plantations from the sea-blast by rearing a thickly planted belt of such trees and shrubs as are least liable to be injured by it,—such as willow, broom, furze, elder, sea-buckthorn, thorns, &c. 2d, To plant thick and to considerable extent, so as one part of the plantation may afford shelter to the other, and not to prune too early or too severely. 3d, To break the ferruginous *pan* by the trench-plough, when not attended with too great expense. 4th, To fill up the plantation yearly during the first seven years with new plants where the old have failed.

In the year 1830, the Governors of the Merchant Maiden Hospital of Edinburgh gave instructions for planting around the Castle of Ravenscraig and on the banks of the Ugie. The plantations consist of Scots fir, larch, ash, birch, sycamore, mountain-ash, elm, beech, and alder; all of which appear in a thriving state, and, having been planted chiefly from the seed-bed, have made as much progress as could have reasonably been anticipated.

At the same time, the Governors gave instructions for planting about fifty acres of the hills of Auchtigall and Collie-law. These hills are of poor moorish soil, consisting of dead moss, gravel, and flint, resting on *pan*, and covered with heath and moss. The subsoil is composed of gravel, intermixed with clay. The ground was enclosed with earth-dyke and ditch, sown on the top with furze, which has thriven well. The trees planted were chiefly Scots fir, larch, and spruce, with a small mixture of ash, birch, beech, alder, and oak. They were planted from the seed-bed with the diamond-dibble, at three feet apart. The plantation has been thrice filled up with young plants. The firs have succeeded as yet very well. The ash and beech have failed the most. The alder, birch, and oak, especially the birch, look healthy where the roots have reached the subsoil. The beech appears to thrive where the ground had been previously prepared by breaking the *pan*. Transplanted trees did not succeed so well as the seedlings, in consequence, perhaps, of being brought from a rich to a poor soil.

If the plantation on these hills shall ultimately succeed, which its present appearance gives reason to expect, there can then remain no doubt that many parts of Buchan may be planted with great benefit to the adjoining lands,—affording shelter—meliorating the climate, and beautifying a district excelling in grain, grass, and cattle, but wanting woodland.

There is no doubt that if, instead of the diamond-dibble, the common spade were used in slit-planting, and the mattock also taken to break the *pan* below the slit, larger plants might be planted with certainty of taking root. I have observed that, however careful the planters were in planting with the diamond-dibble, many plants never took root in the soil, owing either to their not having been put deep enough into it, or the roots having been doubled up in introducing them into the ground, the root as well as the top of the

plant become thus exposed to the action of the atmosphere. The expense of using the mattock is from 15s. to 20s. per acre. For this reason, I made an arrangement for filling up the plantations with the spade by slit-planting, under the immediate inspection of the Hospital's hedger, Thomas Donaldson. In this way, 114,500 plants have been put into the ground, being rather more than 2800 to the Scots acre,—consisting of Scots fir, spruce, alder, and birch, part of which were seedlings, and part one, two, and three years transplanted. The ground is now very closely planted, and I do not anticipate that it will require again to be filled up except in very particular situations.

The progress made by the young trees last summer was on the whole satisfactory. Some of them attained eighteen inches—some from an inch to a foot, while others merely kept alive. This, I believe, is what takes place in plantations in moor ground in most situations. It would be impossible for me to form a decided opinion of the ultimate result, but, in the mean time, it is cheering to observe that the plantations are equal to others of the same age in more favourable soil and climate. I had formed an opinion that, before planting, it would have been of use to have burnt the dead moss and heath. The planter was of a different opinion, and thought that the heath and moss hillocks would afford shelter to the young plants, and certainly where the plants have derived shelter from the heath or hillocks of moss, they have thriven better than where exposed. But where the moss and heath had been accidentally burnt, the young wood has made much greater progress than any where else. I have this spring (1836) trench-ploughed, fallowed, dunged, limed, and planted a belt at the Blackhill, chiefly with the different varieties of hard wood trees, of as many sorts as I could easily get, in order to answer the descriptions best calculated to thrive in the soil and situation.

[A piece of Plate of L. 10 value was awarded to Mr Lawson for the introduction of the *Pinus Austriaca* as a forest tree hitherto unknown in Scotland.]

ON THE *PINUS AUSTRIACA*, OR BLACK FIR OF AUSTRIA. *By Mr CHARLES LAWSON, Seedsman to the Highland and Agricultural Society of Scotland.*

Two years ago my attention was directed to the *Pinus Austriaca*, Black Fir of Austria, from seeing a description of it in a work by Francis Hoss, professor of the science of Forestry in the Imperial School of Forestry at Mariabrun, near Vienna, entitled, “Guidance to determine the Trees and Shrubs of Austria;” in which, by a long and minute botanical description, he proves this fir to differ essentially from all the others described by him,—in that it naturally thrives best on cold, dry, poor, sandy, or gravelly soils,—and that it grows rapidly, and yields timber of the first quality. During my visit in 1834 to the Continent, finding that since Professor Hoss’s publication had appeared, much attention had been directed to this valuable tree, and understanding that the best authorities coincided in stating that cold stony soils, rocky situations, and rough climates, are best adapted for it, and that it there thrives much better than any other tree,—and also that rich deep soils, warm situations, and warm climates, are quite unsuitable for it, and that it grows vigorously on plains of poor soil, if it be dry and contain a quantity of broken stones or gravel,—it appeared to me that the introduction of so valuable a tree to the forests of our country was an object of some importance.

The timber of the black fir is represented to be very resinous, firm and tough, and very valuable for all water-work purposes, in which it is greatly preferred to larch, as also esteemed by the joiner and cooper. When used as fire-wood, it produces a speedy and long-lasting heat, burning with a violent flame, and throwing off a large quantity of pine-soot

(lamp-black). For making charcoal, it is preferred to the wood of the beech. The chips of the timber are used by the peasantry in several parts of Austria for lights in place of candles, and it produces more turpentine than any other resinous tree.

In Austria this fir predominates in the Wienerwald, the Banate, on the Domoglet at Mehadia, near the Hercules Baths, in the vicinity of the Austrian snow mountains, where it rises higher than the *Pinus sylvestris*. Through the medium of my friends Messrs Booth at Hamburgh, I obtained a quantity of the seeds last year, which have grown luxuriantly in our nursery on light sandy soil, having long penetrating roots, and, as one year old plants, are double the size of our own country Scots fir. The seeds pretty nearly resemble those of the *Pinus Laricio*, but from which the tree differs essentially and is easily distinguished in an advanced state, by having stronger and more spreading branches, and the leaves or needles wanting that tortuous appearance which those of the *P. Laricio* present.

Having had an opportunity of conversing with Mr Vilmo-rin at Paris about it, in the summer of 1835, I found that he was aware of its valuable properties, and considered it of quicker growth than even the *P. Laricio* or Corsican pine, and that it is nearly allied to the *Pin de Calabre* and *de Romanic*, both of which are little known in this country, and I believe not so quick in growth as the *P. Austriaca*, nor so well fitted for the mountainous districts of Scotland, for which I should consider the Black Fir of Austria to be eminently suitable.

ON THE PRESENT STATE OF THE UPPER WARD OF LANARK-SHIRE. *By Mr DAVID WILSON, Walston Manse.*

Situation, Extent, and Appearance.—THE county of Lanark is divided into three districts, termed Wards. The ward which forms the subject of the following observations is in the south-eastern part of the county, and is called the Upper Ward, from its proximity to the source of the Clyde. It comprehends nearly two-thirds of the whole county, and embraces an area of 554 square miles, or nearly 354,560 imperial acres. It is divided into twenty parishes, contains a population of above 37,000, and yields a rental of upwards of L.100,000 a-year.

There are but few hills of any great elevation above the surrounding country in this part of the ward ; which circumstance, coupled with the great want of wood and inclosures, and the extensive moors and morasses with which it is interspersed, renders the landscape bleak and uninteresting. The parishes of Crawford, Crawfordjohn, Wiston and Robertson, Lamington, and part of Douglas, which lie to the south of the Tinto range of hills, present a confused mass of dome-shaped hills, ascending to a great height from the streams which wind round their bases.

Rivers.—The river Clyde rises in the parish of Crawford, on the confines of Dumfries-shire, and flows through the whole ward. There are many streams tributary to it ; to the south of Tinto are the Dear, Glengoner, and Duneaton ; the Douglas and Nethan rise on the borders of Ayrshire ; the Culterwater and the North and South Medwyns fall into the Clyde from the eastern parishes ; whilst Biggar-water, which rises in the parish of that name, takes an easterly course, and falls into the Tweed, after flowing through an extensive valley, nearly on a level with the channels of Tweed and Clyde and

on which their waters meet when in flood ; and the Mouse drains the extensive mossy tract of high table land denominated the moorlands of Carnwath and Carstairs.

Altitude and Climate.—The elevation of the Upper Ward above the level of the sea is from 600 to 2450 feet, which is understood to be the altitude of the highest point of the Lowthers. Cultivation is carried on at 950 feet ; but from 700 to 750 feet may be stated as the average for cultivation. The average of sheep pasture is about 1200 feet. The climate is cold and damp, owing to the superabundance of rain brought by the prevailing south-west wind, through a distance of fifty miles from the Atlantic. In spring the east wind prepares the soil for the reception of the seed ; but when it continues longer than the end of April, it is frequently accompanied with frost, and checks vegetation. Frosts sometimes occur in summer and autumn, and prove injurious to the potato and turnip braird, and the crops in low damp situations.

Minerals.—An extensive field of coal stretches through the northern part of the parishes of Carluke, Carstairs, and Carnwath, and another through the parishes of Lesmahagow, and Douglas, into Carmichael. A very fine seam of cannel coal is wrought in Lesmahagow, from which Glasgow and other towns are supplied with gas. Lime is always found and worked near the coal, and burnt lime is furnished for agriculture and building at threepence to fourpence per bushel. There is an inexhaustible field of ironstone on the north bank of the Mouse, in the parish of Carnwath. The Messrs Wilson, Swedish merchants in London, commenced the manufacture of pig-iron at Wilsontown, in the year 1780, and about ten years afterwards an extensive forge was erected for the manufacture of bar-iron. In 1812 the works were stopped, the company having become embarrassed by the depression in the iron trade. In 1821 Mr Dickson, of Calder Iron-works, purchased Wilsontown, and one of the furnaces in

full operation at present makes about sixty tons of pig-iron per week. At Leadhills, in the parish of Crawford, mines of lead have been wrought from a very remote period: these mines are the property of the Earl of Hopetoun, and yield annually about 700 tons. To the north of Tinto quarries of excellent freestone are met with in almost every parish, while on the south of it the most prevalent kind of rock is grey-wacke or whinstone.

Size of Estates and Farms.—The largest proprietors in this district are the Duke of Hamilton, Lord Douglas, Sir Norman Macdonald Lockhart and Sir Wyndham Carmichael Anstruther. Where the land is chiefly arable, farms of from 200 to 300 acres are the most common; and rents may be said to run from L.150 to L.250. There are a few farms above the latter sum, and also a great many under L.150.

Soil and Cultivation.—The soil varies much in nature and quality. The prevailing soil is loam, containing more or less of clay, and is well calculated for turnip husbandry. The parishes of Carluke, Lesmahagow, and Deuglas, contain a great extent of stiff clay land. Peat moss may now be classed among the arable land, since many thousand acres of it have been reclaimed, and the most spongy bogs are no longer viewed as incapable of cultivation wherever there is sufficient declivity for drainage. Cultivation has made rapid strides in improvement, particularly in draining, which has been extensively performed both by landlord and tenant. Farming has not yet, however, arrived at such a state of perfection as in many other places.

This defect no doubt arises from the great want of enclosures and plantations for shelter, the vast extent of indifferent soil, and the impossibility of procuring extraneous manure. It may be stated that the first effective impulse given to an improved system of husbandry here, was by a regular rotation of cropping prescribed to the tenantry upon the Carnwath estates, nearly fifty years ago, by the late Alexander Low

Esq. of Laws, a most judicious land-valuator from Berwickshire, and father of the present talented occupier of the Chair of Agriculture in the University of Edinburgh. The system of husbandry embraces three different branches, viz. :—the Cultivation of Grain—the Dairy—and Store-farming ; and it is very common in the higher parishes for these branches to be combined. It is such farms that are most eagerly sought after, from the greater security which they hold out to the occupier, as the market for the produce of the three branches is seldom or never equally depressed at the same time. The cultivation of moss is here performed at much less expense than hard land ; main drains are first opened, then it is thoroughly intersected with wedge drains, after which the rough surface is pared off and burnt ; a large quantity of ashes are thus obtained, which are laid upon the moss, and are found to be equal, if not superior, to hot lime, in stimulating the inert mass. The expense of improving an acre in this manner, where there is not much levelling required, is about three pounds ; when it must be dug with the spade, about five pounds. Moss, when properly improved, raises amazingly bulky crops, frequently from ten to fourteen bolls of oats per acre. One of the most successful and astonishing instances of this species of improvement was executed by Norman Lockhart, Esq. of Tarbrax, on some moss and moorish ground, on the edge of Carnwath flow-moss, and for the detail and success of this improvement he obtained the honorary reward of a piece of plate from the Highland Society of Scotland in the year 1829. It may be interesting to state that, in the year 1826, one field of this moss, consisting of about eleven acres, after having been drained, was sown with oats imported from Essex, and the produce was sold on the foot at the enormous price of L. 220, being very nearly L. 20 an acre. Mr Muir, farmer in Hardington Mains, parish of Wiston, obtained the Highland Society's honorary silver medal in 1831 for the improvement of moor-

land. The kinds of grain usually cultivated are oats, and barley and bigg; the latter not so generally now as formerly. Wheat but seldom, and it is doubtful if it ever will become a profitable crop in this high district. Pease and beans are sown in those places where wheat is cultivated. The usual rotation is, after two or three years lea,—oats—potatoes or turnips, manured with thirty to forty square yards of dung—barley, bigg, or some of the finer sorts of oats. The correct average per acre cannot be easily ascertained in so extensive a district; about forty bushels of oats and barley, thirty-five bolls of potatoes, and twenty-five tons of turnips, is near the truth. The reaping-hook has hitherto been chiefly used in cutting the grain, but of late years the scythe has been extensively employed. Turnips are both eaten by sheep on the ground, and rooted and topped and carried home to the cattle. Bone manure is now much used for this crop, and on light soils has been found to succeed very well. Lime is extensively used, and from one hundred and twenty to one hundred and fifty bushels are laid upon the acre.

Breeds of Cattle, their Management, &c.—The dairy stock is the Ayrshire breed of cattle. Great attention is paid to the selection and breeding of cattle in this district. The Highland Society's shows have proved that Lanarkshire is very little, if at all behind the county from which this stock takes its name.* Some farmers prefer a cross between the Ayrshire and short-horned breeds; and though the quantity of milk is said to be considerably diminished, yet this defect is compensated by the greater value of such animals for feeding for the shambles. The land allotted for the pasture of the cows is always the nearest to the farm-steading, and is

* The Ayrshire bull which gained the first prize at Dumfries in 1829, was bred at Earton of Dunsyre, by Mr Robert Black. At Ayr, in 1835, the first premium was awarded for a cow bred by Mr Gibson, Skirling Mains; and for yearling queys, the first premium was awarded to Mr John Forest, Sandilands.

not so frequently cropped as other parts of the farm. In summer they are soiled with cut grass or tares in the house during the heat of the day, and at night. In winter their food consists of meadow-hay, or straw with turnips, morning and evening. In spring the turnips are boiled with chaff and dust ; to this mash a small quantity of pease-meal is frequently added. Calves kept for stock are fed daily with four or five pints of new milk, for ten weeks, when it is gradually diminished, and they are put to grass. During the two first winters they receive turnips and straw or hay, and the third winter the queys come in as cows, and the oxen are either kept over another season or are fed off. On inferior soils the want of enclosures compels the young cattle to be herded, which keeps them in continual constraint, and subjects them to particular hours of grazing. This treatment never fails to depreciate their value in the market.

Irrigated meadows are frequently met with ; they are considered of great importance to a farm, as they produce a vast quantity of fodder and manure at a small expense ; where they are properly constructed they yield from two to three hundred stones of hay per acre, which is held in great estimation for milch cows and young stock.

Management of the Dairy.—The affairs of the dairy are conducted with knowledge and neatness ; particular attention being paid to the state of the milk-house and vessels. Both butter and cheese are generally made, but in some parishes Dunlop or sweet-milk cheese only is made. The Highland Society having in different years offered premiums for Double Gloucester, Stilton, and North Wilts, which were open to all Scotland, several competitors appeared from this district, among whom Mr William Sanderson, Blackcastle, was eminently successful, having gained first prizes for all these varieties, and also for Dunlop cheese. Mr Nicol, Easterhouse, was also successful in Stilton and North Wilts cheeses.

Horses.—Lanarkshire has long been celebrated for its

breed of horses, and the Upper Ward has contributed greatly to keep up the high character of the Clydesdale horse.* Each farmer has generally a mare or two in foal every year; they all do farm work in winter and spring, and, not being constantly required in summer, they are put to grass with the foal.

Store-Farms. — Store-farming constitutes the principal branch in those parishes to the south and south-west of Tinto. The farms that are exclusively sheep-walks are of great extent, and partly separated from each other by stone dykes. The hills are dry, and the herbage is plentiful, many of them being covered with a green sward nearly to the summit. On the banks of the Clyde and its tributaries there are considerable tracts of level land, where the herbage is of excellent quality. Of late years a great deal has been done in surface-draining, which has tended to improve the pasture in a high degree. In this part of the Upper Ward, as well as in the north-eastern part, there is great want of planting to shelter the flocks from the blast. At present the ring fences and mountains are their only fields.

Breeds of Sheep, &c. — The flocks of sheep are of the black-faced and Cheviot breeds, the former still constituting the principal stock. The black-faced sheep in the district under review have undergone great improvement of late, and they are not excelled any where in Scotland for the quality of the wool or weight of carcass, so much so, that farmers in other counties of Scotland find it advantageous to purchase their breeding stock from it. Cheviots, from the superior quality of their wool, have been introduced wherever the pasture is suited to them. The desire to stock with Cheviots is so great, that where the pure breed cannot be introduced with success the black-faced breed is crossed with them, and the wool of the cross often rivals in texture that of the pure

* The mare to which the first premium was awarded at Ayr show last season was bred by Mr Thomas Brown, farmer, Gladstone.

breed. Ewes are cast-off at five and six years old, when they are either fed-off here, or are crossed with Leicester rams, and sold in spring at House of Muir market, whence they are taken to England and the Lothians to rear their lambs, and be fed for the shambles. On some farms the whole of the stock are crossed with Leicester rams, the lambs sold to the butcher, and ewe hoggs bought in to keep up the stock.

Bars to more Extensive Improvement.—Rapid and steady as the improvements in the district have proved, yet there exist many bars to perfection, such as large entailed estates, long leases of fifty-seven years' duration, difficulty of procuring extraneous manure, distance from markets, and the want of enclosures. These bars to further improvement cannot be easily surmounted.

Recent Improvements.—Of the advantages of improving in these particulars the proprietors of the Upper Ward have shewn numerous examples. In the western part of it, General Sir James Stewart of Coltness adopted, many years ago, a system of enclosing by hedges, which has conduced much to the shelter of his farms, and has highly beautified the country. When the late Mr Stainton of Carron Iron-works bought the property of Biggar Shields, it was lying as a sheep-walk, and rented at L.150 per annum. He enclosed and subdivided the whole property, partly with stone-dykes and partly with hedges, laid it out in fields of various sizes, and planted to the extent of about 260 acres. He limed the greater part of it, and broke up many fields from heather. At present the property is divided into six farms, and yields a yearly rental of nearly L.700. Mr Gray purchased Carwood a few years ago. He has enclosed and subdivided it, and has planted about 200 acres. He has likewise broken up a great extent of hard moorish land, and gone over it with lime and turnips with bone manure. Mr Gray has also erected a bone-mill at Carwood, from which he means to supply the neighbourhood with bone manure. Mr Mackenzie of Dolphinton has of late erected many miles of

stone-dykes, and planted extensively between the arable land and hill pasture. About three years ago he inclosed with stone dykes, surface-drained, and planted, a moor of 140 acres. He has also constructed extensive water-meadows. Mr Cuninghame of Newholm has, by planting, enclosing, and improvement of moss and marshy ground, rendered his property the most perfect in this part of the country. Lord Douglas is at present employed in extensive improvements on his estates in this ward, in enclosing, planting, and draining, and building farm-steadings on the most commodious and improved plans. Sir Charles Macdonald Lockhart, Bart., and the other proprietors of land on the banks of the South Medwyn, which flowed in a serpentine manner through an extensive valley, cut a channel for it in 1829 three miles in length, thirty feet wide at top, fifteen at bottom, and six feet deep. The expense of this cut amounted to about L.1000. The farmers on each side have brought a considerable extent of this land into cultivation by draining and otherwise improving it; and in the course of a few years, about 400 acres, formerly flooded by every spate, and rendered a deformity in the landscape of the vale of Medwyn, will be converted into the best arable land, to the profit of proprietor and tenant, and the improvement of the climate of the valley.

Markets.—Fairs are held, at stated periods, at Lanark, Douglas, Carluke, Carnwath and Biggar, for the sale of horses, cattle, and sheep, and for hiring servants. Weekly markets are likewise held at most of these towns for the sale of farm produce.

Agricultural Societies.—Five local agricultural associations have been formed, in consequence of the impetus given by the great national institution, the Highland and Agricultural Society of Scotland. These meet at Lanark, Douglas, Lesmahago, Carluke, and Biggar. Shows of stock are held annually, and premiums awarded for Ayrshire and short-horned cattle, horses, and sheep. The Biggar Society, a few

years ago, contributed a sum to assist a young man to complete his education as a veterinary surgeon under Mr Dick in Edinburgh, who is now practising in that neighbourhood.

Gentlemen's Seats and Farm Onsteads.—The farm onsteads on many properties are old, and afford too little accommodation; it has therefore become necessary to erect more extensive offices. The erecting of onsteads is always set about at the commencement of a lease, and the tenant, in many instances, is bound to drive the materials, a system that cannot be too much reprobated, particularly where there is much land to be improved, as, by so doing, the farmer's hands are occupied two or three summers when he should be employed in improving his land, and consequently he loses these seasons. The tenant had better pay a fair percentage on the outlaid capital.

Roads.—The turnpike roads in this ward have undergone great improvement of late years. The new road from Carlisle to Stirling, as laid down by the late Mr Telford, and which is carried over the Mouse by the stupendous bridge at Cartland, passes through it for about twenty-six miles; it is joined at Abington by the Glasgow branch. The road from Edinburgh to Dumfries by Biggar, and which passes along the banks of the Clyde, has of late undergone extensive improvements in several places. The road from Glasgow to Hawick is the worst of the turnpike roads, there being several severe pulls in it where trace horses are required. A much superior line might be easily obtained for the worst part of this road, through the parish of Dunsyre, and along the banks of the Tarth to the junction of the Peebles road with the road from Edinburgh to Dumfries by Noblehouse. The parochial roads are, in too many instances, very indifferently laid out. An act of Parliament has lately been obtained for this county, authorizing the converting some of the parochial roads in this ward into turnpike roads, and building a new bridge over the Clyde at Lamington, which is in progress. It may be interesting to

state, now that railways attract universal attention, that in 1803 the country was surveyed, and plans and sections made by the late Mr Telford, civil engineer, for a railway between Glasgow and Berwick, which would have passed through this district. It was to have entered the parish of Carluke, near the village, passed on through Carstairs, to the southward of the village of Carnwath, and then followed the courses of the Medwyn and Tarth.

Conclusion.—In taking a retrospective view of the Upper Ward of the county of Lanark, it must be admitted that, notwithstanding the disadvantages with which it has had to contend, it has made very rapid strides in the march of agricultural improvement. The tenantry yield to none in point of energy in proportion to their capital, and, considering they have so high an elevation to contend with, and a deal of indifferent land, their barn-yards and cattle-sheds afford the best criterion whereby to judge of their agricultural skill and enterprise.

ON THE EXTIRPATION OF FERNS FROM PASTURE LANDS
WHERE THE PLOUGH CANNOT BE USED. *By Mr M'TURK,*
Hastings Hall, Minnyhive.

[The loss experienced by the prevalence of ferns in many of the hill pastures in Scotland, induced the Society to offer a premium for the best and approved account, founded on experience, of a cheap mode of eradicating them from all pastures, and particularly from hill-pastures where the plough cannot be employed. A premium of Seven Sovereigns was awarded to Mr M'Turk for his Essay on this subject ; and the thanks of the Society were given to the Honourable James Murray for his communication.]

THE *Pteris Aquilina* of Linnæus is one of those plants that may be found on every hill, in every wood, and almost in

every uncultivated field in Scotland, and is familiarly known to every person as the common fern, or bracken. It abounds in the rocky and heath-covered mountains of the north, as well as in the rich and grassy pasture lands of the south. There is perhaps no plant so widely distributed in this country of so little real value; for in almost all the uses to which it was applied before agriculture and the arts had attained their present eminence, it has been nearly altogether superseded. In every stage of its growth it is spurned as food by every domesticated animal. As thatch, except in some of the meanest hovels, it has given way to slate, tile, straw, and heath. In the soap and glass manufacture, its ashes are now unused, from the expense of obtaining them in sufficient quantity. For tanning, it contains the astringent principle in an inferior degree to any of the other substances in use. As a vermifuge, it is only supposed to be so. In some districts, however, it still continues to afford a cheap litter to the labouring classes for their cows and pigs, and a sure protection to their potatoes against the frosts of winter. It is not only a plant of little value in itself, but it is one of the most hurtful that infest our driest and best pasture-lands that have never been cultivated. For, wherever there is a field of this description, with a soil deep and dry, in most cases it will be found more or less covered with ferns; and if it contains any hollows where there is more shelter, and the soil is still better, these injurious plants will be found to have obtruded themselves in greater quantities; and wherever they do prevail, the finer and more valuable grasses which occupy the soil are found weak, insipid, and destitute of their usual flavour, in consequence of the deprivation of a free circulation of air, and of the sun's heat and light, so that they are rejected by sheep and cattle in summer; and when the leaves of the ferns fade in autumn, the sickly herbage under them is nipt by the first frosts, and completely withered by the commencement of winter. Ferns must also have a tendency, from the manner in which their roots

ramify, to impoverish and exhaust the land in which they grow, and thereby extract a considerable portion of the nourishment which the grasses in their neighbourhood would otherwise receive ; moreover, during the heat of summer, the sheep run to them for shade, and, from the numbers of flies that are bred in and haunt the shade, they become one of the most fruitful sources of the maggot.

I have been accustomed to the management of extensive sheep-farms ; 200 acres of the lowest and best pasture of one of which were more or less overrun with ferns ; and on some of the best land they grew so close and strong as to be almost impenetrable to sheep. I therefore felt anxious to discover a cheap method of extirpating them altogether, or of diminishing their numbers.

The first idea that occurred to me was to employ people to cut them for a few years in succession, thereby to ascertain whether that might be a means of extirpating them ; and upon mentioning the idea to my father, he stated that in his younger days he had seen the cutting process tried, for at least twenty years successively, in different stages of their growth ; and, upon pointing out the place of experiment, it still remained one of the completest forests of ferns in the whole farm.

Having observed the favourable change produced by draining on pasture grass and wet land, it occurred to me that, by changing the nature of the soil for a few years, the ferns might be destroyed ; and that the desired result would be attained, were naturally dry soil, the favoured seat of the fern, irrigated for a time. Following up this idea, my first object was to select a portion of the farm best fitted for irrigation, and to run to it a few sheep-drains that would contain a sufficient quantity of water. The operation of flooding was begun in April 1825. The ferns that summer did not come up so strong, nor did they in the course of it attain to the luxuriance of the preceding. The alteration was still more perceptible during the summers of 1826 and 1827, progressively decreasing in every respect ; and in 1828 the most of them had

disappeared ; any of them that did survive were in those parts least under the influence of the water, and were so sickly as clearly to indicate that they could not continue to live under such a treatment. I removed from the farm at Whitsunday 1829, as did also the shepherd who had the charge of the experiment ; and I believe the present tenant has not continued the operation.

The farms now under my management are not subject to the fern, the soil being chiefly of a moist nature, such as to require draining instead of flooding. But my experience has left no doubt on my mind that ferns can be extirpated from hill pasture, in the manner above described, where there is a sufficient command of water, either arising from sheep drains, which can be made at the rate of 15s. per mile, or by taking advantage of natural springs or rivulets, which are to be found in almost every hill side ; and it is possible, in most cases, to plan the sheep drains so as to effect this object, without incurring much additional expense ; for a much less quantity of water is sufficient to extirpate ferns, than to irrigate the same extent of ground. The irrigation need not be commenced before the middle of April, nor continued after the middle of September, when the growth of the ferns appears to be over. At the same time, I am convinced the more water that is applied the extirpation will be the more perfect, and could the flooding be carried on with safety through winter, the end in view would be sooner attained, by the total destruction of the roots of the ferns.

The experiment here narrated was tried on upwards of twenty-five acres, one-half of the surface of which was nearly covered with ferns. The whole expense did not exceed 6d. per acre, for it did not require so much as 200 roods of drains beyond what was necessary to dry the wet land on a higher part of the farm ; which drains were then made at 6s. per 100 roods, the making of them at present being readily taken at 5s. per 100 roods ; but this cost must of course vary ac-

cording to local circumstances. But suppose that twenty acres of land lying contiguous, and in every other respect unfavourably situated for irrigation, 1000 roods of drains would regularly intersect the whole, not leaving a greater space between the drains than sixty feet, which is nearer than absolutely necessary. Suppose further, that the water has to be brought a mile, and allowing twice the sum per rood for bringing it, the whole expense would only amount to L.4, or 4s. per acre, a sum much less than ferns could be extirpated for in any other way. For, suppose that cutting them for three years successively, when in a succulent state, would have the effect of destroying them, and that they might be cut yearly for 2s. 6d. per acre, twenty acres would in the course of three years cost 7s. 6d. per acre, or in all L.7, 10s., being nearly double the expense of irrigation, and the roots would still remain in the ground nearly as strong as ever.

How far salt or wood-ashes would have the effect of destroying ferns, I cannot pretend to say, having never tried either; but were they even found to answer the purpose, the expense must ever prove a sufficient obstacle to their employment on a large scale. No benefit would result from the use of salt if applied in smaller quantities than five bushels per acre, which, in point of quantity, would be considerably less than a common sowing of oats; the twenty acres in this way would cost for one sowing 10s. per acre, or L.10 in all. Nor would the application of wood-ashes be attended with a beneficial result, unless applied at the rate of a moderate liming, say four cart-loads per acre, especially when it is known that they and the salt would not only have to penetrate the soil to the depth of four, five, and six inches, on an average, before coming in contact with the top of the fern roots, which generally run in a horizontal direction at these depths, but to reach them in sufficient quantity to destroy them. A cart-load of ashes, at the lowest estimate, is worth, for raising turnips, 4s., consequently, the twenty acres would

cost, for one application, L.16, or 16s. per acre. The relative costs of irrigation, cutting, salt, and wood-ashes, stand thus :—

Eradication by flooding,	.	.	.	.	.	4s.	per acre.
On the supposition that	{	by cutting,	.	.	.	7s. 6d.	—
these methods would		by salt,	.	.	.	10s.	—
really extirpate ferns,		by wood-ashes,	.	.	.	16s.	—

ON THE BEST MEANS OF ERADICATING FERNS FROM PASTURES. *By the Honourable JAMES MURRAY.*

AMONG the hill-pastures of Scotland, the plant called the Fern covers, in many places, the surface of the ground to such an extent, and by its imperviousness, so totally precludes the growth of grasses, as to render the ascertaining of some method whereby it may be extirpated, a matter of no small importance to every one connected with agriculture, but more particularly to the proprietors of sheep walks.

One of the first instances in which my attention was drawn to the necessity of devising some method of destroying the fern, was the circumstance of witnessing the young plants, in a wood of two years' growth, much injured by being choked up by it. As the first and most simple remedy which I could think of, I had them cut over ; but next season they were as luxuriant as ever, and another cutting did not effect what I wished—the entire destruction of the plant. Thus cutting will never injure them. I thought so before leaving Scotland, but the circumstance which has caused me entirely to reject the idea, that cutting over the fern, at any period of its growth, or at any season, will eventually have the effect of destroying it altogether, was the following :—To the north of Pau, there is a plain some miles in length, and containing several thousand acres, which was by Henry the Fourth of France, from the affection which he bore his old friends and neighbours, be-

stowed upon the inhabitants of Pau, who have held it in common ever since. It is covered entirely with heath, short furze, and ferns, the latter plants growing as strong and numerous as I have ever observed them to do upon our own hills. The people have besides the right of pasture, for as many cattle or sheep as they may choose to put on it, also the privilege of cutting the herbage for litter. For this purpose, and that they may not interfere with one another, they generally stake off a spot which they intend cutting, and no one thinks of intruding upon it. Of course, the most level places, and those most productive of the above plants, but particularly the fern, the best adapted for their purpose, are eagerly sought after. The peasants fix upon no particular season for cutting and storing their litter. I have seen them cutting the ferns at all times during summer and winter. At first I thought, from the great extent of the common, that the same particular spots might not be cut in each succeeding year, and that thus the fern might be allowed to regain its strength, if injured by the cutting of one year. But I found, upon inquiry, that it was not so. The same spots, those the most level, and nearest the town or turnpike road, were sometimes cut twice, but always once in every year, and there the ferns equalled in luxuriance those growing in any other parts of the common. This system has been pursued by the peasants for generations, but notwithstanding so many cuttings, the fern plant flourishes nevertheless, and yearly strikes out its shoots as beautifully. I have no doubt, as when Henry the Fourth, in the days of his boyhood, used to course among them.

I also endeavoured, when in Scotland, to pull them up, but the great length and strength of their roots almost always prevented this being done effectually.

I tried trenching, but even this was not altogether successful. There is hardly another root with which I am acquainted which is so tenacious of life as the fern; and plants which I have buried deep in the ground, beyond, as I conceived, a

possibility of their vegetating, have yet in the next year sent forth their shoots.

The effects of salt upon this plant I have never tried.

Of the inefficacy of wood-ashes I can speak from experience, because I have frequently seen a fern plant growing magnificently in the centre of a spot where the accumulated thinnings of wood had been burnt.

But there is still not only a certain, but also a simple mode of eradicating this hardy plant, and one which is more particularly in the power of sheep farmers to adopt. But in order the more readily to foresee the success of the method which I would recommend, let us for a moment consider the nature of the plant, and the particular quality of the soil in which it delights to vegetate. It differs from most other plants in one material instance, for unlike them it requires very little moisture, and, accordingly, the soil in which this plant is found most perfect is invariably of a dry and gravelly nature, whether in the plain or upon the hillside. It must therefore be obvious, that as we cannot, do what we will, so maltreat the fern as to make it leave us, we must so endeavour to change the character of the soil in which we find it, as to render it no longer of the nature requisite for its production. Wherever we can accomplish this change, we may be confident that we shall no longer have the object of our annoyance. Irrigation I therefore look upon as the means to be employed for this end. We generally find the fern growing most thickly along the base of hills, and covering the banks of every little stream which comes down their sides, almost to its source. The ground thus occupied by the ferns, and where they altogether prevent the growth of any other plant, is of the description for pasture, and upon farms with which I am acquainted, hundreds of acres are thus rendered unprofitable, which, with very little labour and expense, might become so productive, as to enable those farms to maintain almost double the stock which they at present do. What can be a more simple

operation to the sheep farmer, than to turn the water from some of the many streams which uselessly brawl down their channels on his lands, into small cuttings, a spade's depth, the primary one leading from the brook, along the highest part of the ground occupied by the ferns.

ON THE SETTLEMENT OF CROFTERS. *By ALEXANDER THOMSON, Esq. of Banchory.*

[The object of the Society, in offering a premium to the proprietor who shall transmit to it the most satisfactory report of a system of improvement carried on on his estate, by settling crofters on waste lands, is, that the Society understanding that considerable improvements have been effected in some parts of Scotland, by establishing crofters, with a few acres of land, on ground not previously in cultivation, and where, from the natural barrenness and expense of cultivation, no farmer of capital can be induced to settle, it has been thought that the system might be advantageously adopted in many districts of the country similarly circumstanced, if the details were generally given. The gold medal was awarded to Mr Thomson for his report.]

THE subject of the following report is a tract of about 300 acres, lying to the north of the road leading from Stonehaven to Aberdeen, and about half a mile to a mile distant from it, except at one point, when it comes within 300 yards of it. It consists of a flat half-worn-out moss, with several eminences rising from it. The sea is about a mile distant from the nearest part ; and the highest point rises, it is supposed, about 350 feet above the level of the sea.

The situation and exposure are about as unfavourable as can be, with the exception of the vicinity to Aberdeen, which in about five miles from the most distant parts. Before the improvements began, the whole was covered with heath ; the soil

very thin, and below it a thin hard stratum, here called a *pan*, often not more than an inch thick, impervious to water, and under this a bottom of light yellow clay. The tenants of the rest of the property claimed a right, by use and wont, to drive their cattle to pasture on it in summer, and also had a right to cast peats from what remained of the moss. But for these purposes, the hills were of no value whatever, and no rent was drawn from them.

The following are the principal part of a set of conditions, which, after considerable deliberation, were determined upon in 1821, on which lots of this ground should be let.

1. The leases to be for twenty-seven years from Whitsunday 1823. This period was considered long enough to enable an industrious man to reap a fair reward for his outlay.

2. Each tenant to take possession within three months of the date of his offer, to improve one acre within the first year, one-half of his lot within the first nine years, and the remainder within the second nine. The object of this condition was to prevent persons taking leases, and then not taking possession, and thus hindering the lot being let to another for an indefinite period; and also to ensure the whole having been at least nine years under culture before the end of the leases.

3. The cottages to be built of stone and lime, or stone and mortar, *sneck-pinned* with lime, with a *set-on* roof covered with thatch or heath, not to be under 30 feet by 13 feet within walls, and each end to have a chimney of stone or brick, and to be *harled* (rough cast) outside, within twelve months after it is built. To assist in building these houses the proprietor gives L. 5, and furnishes windows; and at the expiry of the lease an additional sum of L. 5 will be allowed, if the house be then valued at L. 12, 10s. With regard to the cottages, there was some hesitation whether the proprietor ought not to build these houses at once, and deliver them over, ready for occupation, to the tenants, free of expense. On consideration, it appeared that building the houses for them would lead persons of neither capital nor industry to

come forward as applicants. The plan appears to have wrought well. Three sash-windows are furnished for each house, two for the front, four feet by three, with twelve panes of glass, and a small one of four panes, hinged, for the back. They cost, on an average, L. 2:12:6 for each house. The windows are given rather than a larger sum of money to encourage cleanliness, and they have had to a considerable extent the desired effect.

4. Each tenant to lay out a garden in front of his house, of not less than one-eighth of an acre, enclosed by a wall or hedge. Some have tolerable gardens, but the country-people are by no means aware of the advantages of a good and well kept garden, nor of how much food for the family it will supply.

5. Offices to be built behind dwelling-houses, and at least thirty feet distant. This promotes cleanliness, and keeps the dunghill away from the house-door.

6. Stones removed in the course of improvement to be laid down along the outer boundary of each lot. The tenants are not obliged to fence their lots, it was thought too much for them; but one or two have built fences for their own convenience.

7. Any tenant may subset the whole of his lot on his providing a tenant approved of by the proprietor; but no one may subset a part of his lot. The lots are too small to be divided, besides the risk of acquiring a pauper population. It would not be fair to tie down an industrious young man to a few acres of ground. Several have taken lots, built and improved a part, and then subset or sold the lease to very good account.

8. The tenants bind themselves, during the last eight years of their leases, to observe a regular rotation of crops, by turnips properly manured, drilled, and cleaned, and by not taking more than two grain crops without an intervening fallow or turnip crop; and also by letting grass lie at least two years in pasture after a hay crop.

The rents were fixed at 1s. per acre for the first nine years; 3s. to 5s. an acre for the second nine; and 10s. to 20s. for the last nine, according to the soil and situation of each lot. I have now let altogether 138 acres 2 roods to twenty-three individuals, but two of these have adjoining farms, and require no houses on their lots; so that there are twenty-one families now settled and thriving, where a few years ago there was nothing to be seen but *brown heather*. The lots vary in size from fourteen to two acres each.

The expense which I have incurred is not great, and I have already a good return for my outlay. I may mention, that four persons have built houses not in compliance with the regulations, and that two, being resident in the neighbourhood, did not require houses. I have therefore only paid my part of seventeen houses. The only other expense of importance was incurred in making roads; and as the most expensive of these was of great use to a farm, it is hardly fair to charge the whole of it against the hill farms. There are still required about half a mile of metalled road, and a mile and a half of gravelled, to complete what is intended; and these will be carried on by degrees. I calculate my outlay as follows:—

To seventeen houses, at L. 7 : 12 : 6,	L. 129	12	6
To one principal road metalled, and several others formed and gravelled, in all about	100	0	0
Some small ditches have been cut, and a little lime given as a premium for improving; but these have not in all exceeded	10	0	0
	L. 239	12	6

In return I drew L. 4 or L. 5 a-year from 1823, gradually increasing as more lots were let; and on the expiry of the first nine years in 1832, the rents rose to about L. 20, and they increase every year as the first period of the latter leases expires. In 1841 they rise to about L. 55, and before the end of the whole leases in 1850, to L. 70 a-year.

When the ground was spade-trenched by contract, it cost, at the beginning of the leases, L. 8 or L. 9 an acre, which has

gradually fallen to L. 6, which is the present price. When ploughed with a four-horse plough, cross ploughed and broken down with spades, the work costs about L. 4 per acre. Both this and the trenching are exclusive of the expense of removing the stones. Had I been as well aware as I now am of the difference betwixt trenching and ploughing, I would have made it a condition that the whole should be trenched.

Paring and burning have been tried by some of the tenants, and generally raises one good corn crop. The manure commonly used is Aberdeen police-dung, or composts of whale-blubber and moss. Lime is not *generally* applied till three or four years after improvement.

In general, two corn crops are taken to begin with, of which the second is often better than the first, the surface, heather, &c. being more thoroughly rotted. After the corn, some have turnips or potatoes, but others sow grass-seeds with the second crop of corn, and allow the land to lie two or three years in pasture, and then break it up for a regular rotation of corn, green crop, &c. The crops vary very much; seven returns of seed is the highest. I have heard of three and a half to five as not unusual for the first crop.

With regard to the increase of value, the original value of the ground must be reckoned *nothing*; and I find that those lots which have been *sublet*, are now yielding from 25s. to 35s. an acre, besides my rent.

I mentioned that the hills contain about 300 acres; of these 150 are in course of improvement, and at the end of the leases in 1850, will let for L. 2 an acre, making an addition to the property of L. 300 a-year, from ground which never paid rent before; 25 acres were planted in winter 1832-33; 35 or 40 more are destined to be planted. The remainder, 85 to 90 acres, is an old peat-moss, very flat and very wet. The peats in it are nearly exhausted, and a plan is under consideration for draining the whole effectually; after which it will probably be let, like the rest of the hill, in small lots for improvement.

REPORT ON THE SETTLEMENT OF CROFTERS ON THE ESTATE
OF KILCOY. *By COLIN MACKENZIE, Esq. of Kilcoy.*

THE part of the estate of Kilcoy which has been appropriated to the use of crofters, lies in the parishes of Kilmuir Wester and Suddie, in the Black Isle of the county of Ross. Its distance from the sea is from one to three miles, and the height above its level is from 100 feet to 300 feet. The climate is on the whole excellent, and the exposure good, the greater part of the land lying along the southern face of the gently-sloping ridge which runs along the middle of the Black Isle. The ground was wholly covered with stunted heath, affording little or no pasture. The soil consisted of a light clayey sand, with vegetable matter of a few inches in depth, and the subsoil of a deep sandy clay and loose breccia, lying upon red sandstone or sandstone conglomerate, which forms the predominating rock of the Black Isle. On a part of the lands there is a thin stratum of hard sand and gravel, impregnated with oxide of iron, lying betwixt the mossy soil and clay subsoil, which retards the growth of trees, but which can be easily broken by the spade or plough, and soon decomposed by the air.

The system of crofting commenced on the Kilcoy estate eighty or ninety years ago. Little attention was at first paid to the quantity of land which each crofter should receive, or the proportion which he should annually improve, but as the land was improved by degrees, favourable leases were granted to the crofters for the improvement of more.

Without arable land adjoining, it was, however, difficult to procure crofters of skill and capital, to erect sufficient houses, and improve uncultivated tracts, so as at once to form them into farms, even when little or no rent was exacted and encouragement otherwise held out. The ground was nevertheless capable of being converted into a good soil by the spade or plough, when it would not have grown timber of any value.

Mr Mackenzie states the mode and conditions on which he has let one of the new divisions, and also the terms on which he has relet one of the districts which has been long in possession of crofters. "Three farms," says Mr Mackenzie, "and each containing about sixty imperial acres, were let in 1832, on a lease of thirty years, to tenants of supposed capital. They are to pay 1s. per Scotch acre for each of the first seven years, 2s. 6d. for the next seven, and 7s. 6d. for the remainder of the lease. They are bound to inclose and subdivide with stone dykes, and to build good houses and suitable offices (the proprietor affording the necessary wood), and to improve and have under crop, one-half of the ground let within *nine* years, and the remainder within *fifteen* years, under a penalty of L. 1 Sterling of additional rent for each acre of ground left uncultivated, until the same is improved.

"The crofts, containing from six to twelve imperial acres, are laid off in regular parallelograms, and let for twenty-one years. The rent of these is 1s. 6d. per acre for the first seven years, and 2s. 6d. and 3s. for the remainder of the lease. Wood was allowed for building, but no meliorations at the end of the lease. The tenants were bound to improve one-half in seven, and the whole in ten years, under a similar penalty. Convenient and necessary roads and main drains were made betwixt the boundaries of their crofts and farms, at the proprietor's expense, the crofter making the smaller ditches. The value of the wood allowed for each house may be estimated at from 25s. to 35s., and the expense of making the roads, which are 13 feet wide, at 3d. per yard. No ditches were required in this part. In 1832, in consequence of the demand for crofts being greater than could be supplied at the place above mentioned, I laid off into lots of six acres each, and let on terms similar to the above, about 200 acres of ground, from which full grown firwood had been cut down many years before. The only expense attending this settlement was that of wood for houses, and the making of a road through the centre of a park thus laid off. Before establish-

ing crofters the ground should be surveyed, and the divisions or crofts marked off on the plan and ground,—and reference made to this plan in a set of regulations applicable to the whole. It is observable, that when crofters are not bound to improve a greater quantity, they seldom bring into cultivation above five acres (if so much) in the course of a lease, however much has been originally given off to them, and as six acres is sufficient for maintaining a cow and a calf, it is considered proper not to give more to any crofter, unless he has ability and inclination to manage four or five lots, on which two cows and two small horses may be maintained. It is quite proper and necessary to put some rent on crofts, but as the improvement of the land is the great object, a very small rent only should be exacted at first, and a moderate one during the last part of the lease. The tenants themselves are frequently their own architects, and can *always* (giving their own assistance in some way or other) get their houses built at much less expense than the proprietor can, and it is better that the proprietor should not erect houses, but always afford the requisite wood for roofs, doors, and windows. An extended lease is the greatest encouragement which can be held out to a crofter, and the lease should not be less than nineteen years, if the ground is in a state of nature, and if its improvement is the object in view. If for a less period, the crofter dreads a rise of rent, or the prospect of another usurping his place and reaping the fruits of his toil and labour, and is daunted in his improvement, and stops short as soon as he has reclaimed barely sufficient to supply his urgent needs.”

“The district of Upper Knockbain, which means, in Gaelic, the white or uncultivated ridge, is situated on rising ground commanding a view of both arms of the sea betwixt which it lies, namely the Frith of Dingwall or Cromarty and Monloch Bay, above which it rises more than 200 feet. The soil and subsoil are both in general good, the one being a sandy clay, and the other a strong clay not over retentive, of

considerable depth, lying on red sandstone, but in some places too hard to receive the roots of trees freely ; for which reason it was early appropriated to crofting. The first house was built about seventy years ago, and from that period settlers have increased. No particular boundaries were marked off to the original settlers, but liferent leases were granted to them of whatever they improved. The whole rent exacted was a few days' work in harvest and spring, and a few hens. In some cases leases were granted for a stated number of years, and wood was allowed for building houses, or their value promised at the end of the lease. Liferent leases are in general to be deprecated, but they seem to be attractive to the people, and when it is desirable to begin a colony they may be resorted to with advantage."

It appears that in the course of about forty-five years, 117 acres 3 roods 19 falls imperial had been brought into cultivation, which in 1799 drew a rent of L. 82 : 1 : 6. From 1799 to 1819, or in twenty years, 62 acres 3 falls were improved, and the rent increased L. 69 : 3 : 6. From 1819 to 1831, or in twelve years, 60 acres 30 falls imperial were improved, which, with the addition of about 200 acres of moor ground, brought a farther increase of rent of upwards of L. 100, without any very great outlay on the part of the proprietor. The rental derived from crofters alone on the Kilcoy estate is L. 611, besides 387 hens annually, and the service of one day during harvest or spring of 561 individuals.

SETTLEMENT OF CROFTERS ON WASTE LAND ON THE ESTATE
OF CASTLE FRASER, ABERDEENSHIRE. *By Colonel
FRASER, of Castle Fraser.*

THE land selected by the proprietor for this purpose was part of a considerable extent of moor, called Moor of Corskie, situated on the side of the public road from Aberdeen to

Castle Fraser, distant from Aberdeen thirteen miles, and off the Skene and Alford turnpike-road about one mile.

The soil is of inferior quality, being a shallow light mould, resting on a brownish gravel, and covered with heath, and in some places with whins (furze), with a great quantity of stones of all sizes, partly above and partly under the surface. The aspect of the ground, in its moory state, is altogether uninviting to improvers; and although some attempts were formerly made by neighbouring farmers to bring in a field or two, it did not offer sufficient inducement to them to prosecute the improvement, even in years when their labour met with a better return than at present.

A portion of from four to six acres of this moor was laid off for each croft. The crofters to build neat substantial houses and offices (the latter consisting of a small barn and byre), with the assistance of the proprietor: To be rent free for ten years; next five years to pay 5s. an acre yearly; and the succeeding four years to pay L. 1 an acre; thus making up a term of nineteen years, but to be virtually tenants at will,* and on removal to be paid the value of their houses, and of such stone-fences as had been approved of by the proprietor, after deducting the amount advanced to them by him at the commencement.

The first allotments were let to married men, in the situation of labourers, whose former dwellings stood in the way of improvement upon newly arranged farms. Those preferred were young married men, brought up on the property, well recommended, who would hire themselves as useful labourers to farmers during the more busy seasons, but always employing part of their time in the improvement of their crofts.

In the first effort towards improvement, the crofter dug out of the ground the stones most suitable for building his houses, beginning nearest their site; and in some places, the material was so plentiful on the spot, that the greater part could be wheeled

* The removals for misconduct have only been as 1 to 10 in twelve years.

It will be understood that the crofter could not single-handed, and in a limited time, execute perhaps more than half work equal to L. 10; but during the time of preparation for, and the building of houses, he came under obligations to his neighbour crofters for their assistance, as well as to the farmers for horse work, which he repaid in labour afterwards.

He thus relieved himself from these obligations : Being allowed the privilege of pasturage on the unappropriated part of the moor, and on some peat-bog swards on its border (where he also procured his fuel), he could keep a small cow at his entry, and thus supplied with milk, and the vegetable produce of his garden, he pushed on the improvement of his croft, and was enabled to pay off some of his debt in the first year. As it was necessary for him in the first years to purchase meal, he generally purchased grain with the fodder, and so manufacturing it himself, procured winter food for his cow at the same time. The returns of the crop in the first year were from 3 to 4; and after being manured from the byre, from 5 to 6.

Before the expiry of the first ten years, and ere he had any rent to pay, the crofter has paid his debt, or his circumstances are improved at least to the amount of his interest in his houses ; viz. L. 20, less deterioration,—possessed of two cows and a few barn-door fowls,—his wife contriving, after supplying the family, to sell some butter and eggs ; and while he is employed at hired labour, she manages at home, and does something of out-door work on the croft.

In summer the elder children are hired to the farmers for small wages with victuals, and go to school in winter, the next of age tending the cows on the moor.

This report applies to the establishment of settlers upon ground hitherto entirely waste. Several other settlements have been made in situations where at the outset moor land lay contiguous to a patch of ground already cultivated ; the results have proved equally satisfactory, and of course an earlier return has been made to the proprietor.

**REPORT BY MR LAWSON ON LARCHES RAISED BY HIM FROM
SEED IMPORTED FROM THE TYROL.**

[The larch is affected with many diseases in this country. Some of these have been supposed to arise from a constitutional weakness engendered in the tree from the seed not having been perfectly matured in this climate. The most perfect seed is most probably matured in the Tyrol, the native country of the larch, and it is most likely to produce trees of the soundest constitution. To ascertain the correctness of these suppositions, which may be founded in truth, the Society offered a premium of Twenty-five Sovereigns to any person in Scotland who should, between the 30th October 1833 and 30th October 1835, have raised and sold for planting the greatest number of plants, not fewer than one million of the larch from seed imported from the Tyrol or other regions of the Alps to which it is indigenous, and taken off healthy trees in that country. The Premium has been awarded to Mr Charles Lawson, the Society's seedsman.]

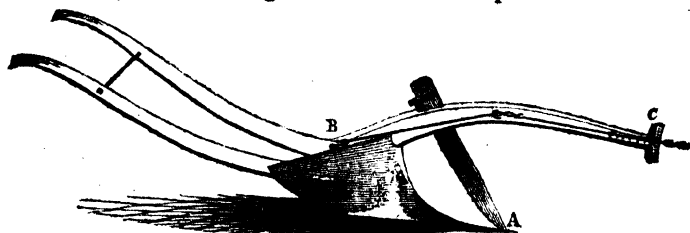
IN 1834 Mr Lawson imported from Messrs J. G. Booth and Co., seedsmen, Hamburg, 250 lb., and in 1835, 450 lb. of larch seed, from the Tyrol. The certificates of the Messrs Booth and Co. attest that "every particle of it was true Tyrolese seed, collected from large healthy trees growing for the greater part in the Tyrol Alps, and that, having received it direct from the Tyrol, with every precaution taken to prevent the possibility of adulteration on its journey, they can vouch for the genuineness of the seed in question." The prime-cost of importing the 700 lb. of seed, including import duty and charges, was L. 115 : 19 : 10. Eighty pounds were sold, and the remainder sown in the Golden Acres and Meadowbank nurseries, producing the estimated number of 2,020,000 plants, which cost Mr Lawson 1s. 6d. per 1000. According to the report of the gentlemen who inspected the

plants in November 1835, the seedlings were stronger, healthier, of a darker green colour, and thicker in the ground, and with less seed in the proportion of three to five than the larch from Scotch seed raised at the same time in the same nursery, and on the same kind of soil. The two years transplanted Tyrolese exhibited a decided superiority of character, growing more quickly, and having the leading shoot longer, and the whole plant of a more healthy and vigorous aspect than the Scotch larch of the same age. The three years transplanted was also in a very healthy state. The number of one year old seedlings sold by Mr Lawson from 17th October 1834 to 11th April 1835 was 233,000, chiefly to nurserymen in different parts of England, Ireland, and Scotland, and to noblemen and gentlemen who have private nurseries of their own. And from 10th November 1835 to 1st January 1836 were sold 328,000 one year seedlings, 204,000 two year seedlings, 45,000 one year transplanted, and whatever there was remaining of the two year seedlings, and one year transplanted plants. Of the one year seedlings, Mr Lawson himself has transplanted from 300,000 to 400,000 in the spring of 1836. The price of the one year seedlings in 1834 was 3s. per 1000, in 1835 2s. ; the two year old seedlings 3s. ; and one year transplanted 7s. 6d. per 1000.

MR MAULE'S IMPROVED CHAIN-PLOUGH.

THE improvement, by the application of a chain or chain bars, in the manner exhibited in the accompanying diagram, to the common plough, was effected by William Maule, Esq. in the year 1832. The chief object was, to give additional security to the beam, by bringing the strain of the draught upon the chain instead of the beam. After repeated trials, it appears from certificates of the ploughmen who have worked the implement, that, besides any advantage in point of strength, they were sensible of an improvement in the ac-

tion of the plough, by its possessing an easier swimming motion than others under the same circumstances. Mr Maule's own views of the improvement are comprised in the following extract from his communication made to the Society :—" A is the point of resistance ; B the point of draught, on which is the whole strain when the chain is used ; C the point of draught, with the common bridle. The point of draught with the chain being at B, the whole strain, therefore, must be in the chain, and none on the beam of the plough. This is evident on simple inspection, without any trial or practical knowledge of the instrument. When the common bridle is used, the point of draught is at the point of the beam C ; when it is equally evident that the whole strain must be on the beam, in which case it is liable to be broken if of wood, or bent if of iron. This frequently happens in ploughing strong or stony land not well cleared of obstructions, and especially in breaking up new ground. The chain, when used, is a complete safeguard against such casualties. It can be attached to the improved Scotch plough, whether of wood or of iron, now in use, at a very trifling expense ; and can be instantly removed and the common bridle used, at pleasure, as circumstances may require. Its simplicity, therefore, is not the least of its advantages. The instrument goes more steadily, and lies more solid with the chain than with the common bridle. This appears from the certificates, and nothing seemed to surprise the men more or afford them more satisfaction. The effect thus produced by the chain arises from the fact, that by the chain the point of draught B is behind the point of resistance



A ; whereas by the common bridle the point of draught C is

at the point of the beam, and consequently before the point of resistance, and it is supposed that such effect can be satisfactorily accounted for on mechanical principles."

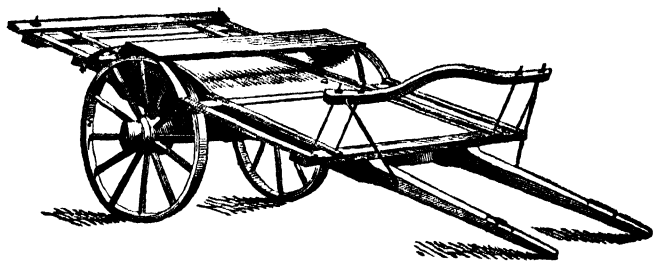
In explanation it may be remarked, that the chain is attached by a hook to the furrow side of the beam at B, it then passes through an eye-bolt fixed into the beam near the coulter hole, and again the shank link is passed through the eye of a moveable eye-bolt in the bridle, this last bolt having the means of shifting up or down, or from land to furrow, to trim the plough in the ordinary manner. The draught is then applied to the fore end of the chain, which here, is formed into a hook.

Note by the Editor.—With reference to the foregoing description of Mr Maule's improvement, we have to notice, that Mr Slight, curator of models and machine-maker to the Society, had about two years ago entered upon an investigation of the principles of the plough, with a view to determine if any further improvement could be effected in the construction of that implement. In the course of the investigation Mr Slight found that a considerable amelioration might be effected in the action of the plough, by adopting a different position for the beam; and his general conclusion was, that if the vertical plane in which the beam acts could be brought to coincide with that point in the body of the plough which forms its *real centre of resistance*, the steadiness of motion would be at a maximum, while the requisite exertion of the ploughmen to guide the implement, as well as the quantity of materials in it, would be at a minimum, and the plough would move with all possible smoothness, in as far as regards lateral vibration.

To accomplish this there appeared some difficulty without injuring the symmetry of the plough, but on examining Mr Maule's chain, it was found that it was in part an approximation towards the object wanted. Mr Slight had drawn up a paper on the principles by which this object may be most effectually obtained, but which must form matter for a separate article. A very little consideration will shew that the *views* entertained by Mr Slight are essentially correct; and though this principle of the chain is not adverted to by Mr Maule, we have no hesitation in saying that the property of the chain, approximating to the vertical plane of draught, or that which would pass through the centre of resistance of the plough's body, forms the most prominent and most useful feature in Mr Maule's improvement, and will satisfactorily account for the steady motion of the plough.

IMPROVED CORN AND HAY CART. *By ROBERT ROBERTSON, Farm-servant.*

THIS improved corn and hay cart is the invention of Robert Robertson, farm-servant to Mr Boosie of Parkhead, near



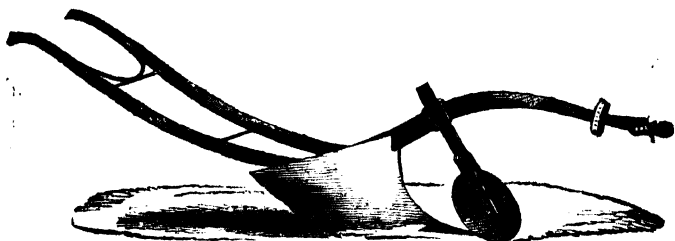
Alloa. It was first employed by Mr Boosie in the harvest of 1832, and gave so much satisfaction that he had three more made for the following season, and it has been adopted by many farmers. The cart is of extreme simplicity in its construction, consisting first of the shafts and usual framing of those intended for the carriage of timber. Upon this is superimposed a wooden frame, extending at once to the breadth of the upper works of the common corn-cart. The outward longitudinal rails of this frame are not continuous, but are cut off before and behind the wheels, and again connected by means of an arched bar of iron. Between these arches, and placed upon the inward rails, there is a board rounded off, to be concentric with the arched bars, and sloping outward, following the dish of the wheels. Across these arches is laid a broad rail, bolted to the former; thus forming a recess for the wheels, and guarding them from rubbing against the load. In front, and immediately behind the horse, a rail is raised, of sufficient height to carry the sheaves above the back of the horse. This rail is supported by two iron stays standing forward on the shafts.

The advantages of this form of cart are, great simplicity of structure, and, what constitutes its chief excellence, the

load takes its full breadth at the very commencement, by which the centre of gravity of the load is brought lower than in either the common corn-cart, or the dung-cart with top-frame, whereby a greater degree of stability and safety against the risk of upsetting is acquired, and a greater facility of loading. Another advantage may be pointed out, in the ease with which it is converted into a cart for the conveyance of timber, by simply unbolting the frame from the shafts, and in its place laying two single cross-bars, one before and another behind the wheels.

CIRCULAR COULTER OR SKIFF ADAPTED TO THE COMMON
PLOUGH. *Communicated by Mr BROOKE.*

THE Society has been favoured with a model and description from Mr G. Brooke, Old Moorhouse, Rotherham, of the skiff or wheel-coulter, as now in use in that part of England. This species of coulter has been long used in some of the fen-y districts, to whose soils it is specially adapted. The cut below shews its application to the common iron-plough. The circular disk, of about one foot diameter, formed of a thin plate of iron steeled on the edge, and turning upon an axis inserted in the cleft or sheers of the bar, is fixed in the beam in the same manner as a common coulter. Its reintroduction and success is thus described by Mr Brooke, in a communication to the Secretary :



“ Ploughing with the skiff was attempted in our neighbourhood I believe thirty or forty years ago, but, either from the ploughmen not being skilful enough to properly adjust it, or

the farmers not perceiving its utility, it gave place again to the common coulter, until the very low prices of grain compelling them to try every means in their power to make up the deficiency by extra quantity and superior quality, the skiff was again brought into use ; and so speedily has it gained ground, that not only the strong land farmers but those even on lighter soils find the benefit of it, though not able to plough over quite so much ground, in consequence of the small stones frequently suspending its revolution by getting wedged betwixt it and the ploughshare. The advantages are at once observable in ploughing when coarse grass is left on the ground ; when ploughed with the coulter a portion of grass remains unburied, which vegetates and robs the crop ; but by using the skiff, it is neatly folded under the furrow, and instead of injuring decomposes and nourishes the crop. The skiff leaves the ground more level than it is usually left when the coulter is employed, and not nearly so rugged, particularly when the ground is hard. The ground requires much less harrowing. On soils free of stones, a pair of horses will plough nearly a rood more per day. The produce is several bushels per acre more, especially when ploughed early in the autumn. The skiff is placed in an oblique direction to the beam, and about four inches more forward than the coulter, so as to allow the nose of the ploughshare to be about 2 inches in advance, and inclined to the left side of the share about $\frac{1}{4}$ th of an inch. My skiffs are 1 foot 9 inches, measuring from the top of the shank to the sole of the skiff."

The subject having been committed to Mr Steuart of Glenormiston for actual experiment, the following is his report to the Secretary : " I have much pleasure in acquainting you, for the information of the Society, that the skiff or wheel-coulter committed to my care for experiment, has succeeded perfectly and given satisfaction. It must of course occur to every practical agriculturist, that the instrument will not answer on stony land, and that it must be kept with a sharp edge."

AN ACCOUNT OF THE PRINCIPAL MARBLE, SLATE, SANDSTONE
AND GREENSTONE QUARRIES IN SCOTLAND. *By Mr J.*
CARMICHAEL, Raploch Farm, Stirlingshire.

(Continued from page 58 of this volume.)

MARBLE QUARRIES.

No true marble quarries have ever been found in Scotland. To be satisfied of the accuracy of this assertion, we have only to attend to the criteria of a true marble—its capability of taking a high polish—its chemical composition—and its homogeneous and compact structure. I shall, in the first place, consider the method of polishing marble. It is this:—The block is placed on its edge, then a saw or slicer, which is a piece of the softest hoop iron, two, three, or more inches broad, two to four-tenths of an inch thick, and fixed in a frame of wood sufficiently large to embrace a block eight to ten feet long by three or four feet broad, is suspended from above by two ropes, with paces, which exactly balance the slicer, without bearing it up too much from the block. A man sits at one end of the marble to be cut, and takes hold of the frame of the slicer, alternately drawing and pushing it to and from him, while two tubs of water are placed on an inclined elevation above the marble, with an outlet near the bottom of each, through which a small quantity of water continually issues, over a heap of the finest sand, which thus flows gently into the opening made by the slicer, which is kept constantly in motion, so that the water and sand are seen passing out at the ends of the block at every movement of the slicer. And in this way one man will cut above six inches deep into a block eight to ten feet long in the course of one day; so that a block three to four feet on the side, will require a week to have one slab cut off it. These slabs are then polished by means of fine sandstone, with wetted sand kept constantly on the surface; and this operation is two or three times repeated, with sandstone of increased fineness, the last being what is

called Water-of-Ayr-stone, of fine and moderately hard texture. The marble is then polished, with a piece of wood of the form of a carpenter's large plane, over which a piece of thick woollen cloth is fastened, and rubbed by the hand over the marble, which is kept still wet, with crocus and water; and the last polish is given by a preparation of calcined tin and mercury, termed *putty*, moistened with water, which is applied with the piece of wood covered with woollen cloth. It is thus manifest, that the polishing of marble is a very expensive operation. Every attempt to polish Scotch marbles has proved that they are incapable of a fine finish, being coarse, and dissimilar in their texture, full of flaws, and having a dull lustre, even when polished to the best advantage. The same remark applies to the Anglesea marble, which possesses some of the properties of serpentine, being of a green colour, and very difficult to polish, on account of its great impurities. The Egyptian marble, even although susceptible of a very good polish, does not take the gloss of the Carrara. But there is another method of ascertaining the fitness of limestones for the chisel—that is, by chemical analysis, which cannot be here gone into. It may, however, be remarked, that, by simply applying muriatic acid to 100 parts of Carrara it readily dissolves, leaving no residuum whatever, while Black Irish leaves 2 per cent; Anglesea, 34 do.; Sutherland, 3 do.; Skye, 2 do.; Tiree, 14 do.; Glen Tilt, 9 do.; Ayton, 4 do.; Springkell, 3 do. It thus appears, that the white marbles contain most carbon, and that the greens, such as Tiree, Glen Tilt, and Anglesea, yield the least. A great defect in these marbles is their heterogeneousness; for when minutely examined, they appear to be a congeries of ill-formed crystals of different minerals, of different colours, such as partly calc-spar and partly mica and quartz. The excellence, on the other hand, of the white and black marbles is their homogeneous and compact structure, which alone induces the glassy polish which is admired by every one.

The white marble of Skye is only a vein occurring in certain parts of the rock, the prevailing colour of which is a clouded silver grey. Assint marble is similar in colour and quality to that of Skye; and, like many of the Scotch marbles, are found amid micaceous formations.

It is vain, therefore, to look for the general adoption of Scotch marbles in statuary or domestic purposes. There are numerous limestone quarries, which produce fine dark blue coloured beds of limestone, nearly equal in colour to the Irish, but without its compactness. For although the latter is found in beds of only six to fifteen inches thick, the joints are so close that two beds are often cut into one block, with the centre joint undisturbed, which adheres so firmly, that the block is generally sliced across the bed, that is, perpendicular to the plane of the quarry, by which these slabs become transverse sections of the rock, and exhibit its striæ as distinctly as a board taken from the centre of a tree shews the fibre and progressive growth of the trunk.

Besides purity of colour, the statuary marble is soft and ductile, as well as durable; and, unlike to all other limestones, even when calcined, shows no symptoms of efflorescence, even although it is so friable as to crumble into atoms, by a slight pressure of the finger.

It is a consolation in the deprivation of so beautiful and useful a rock as marble in our own country, to find that foreign marbles are not now half the price they were during the war. The Italian is 40s. to 60s. per cubic foot, and the Irish 10s. to 12s., which prices certainly can leave little gain to the quarrier, and still less to the proprietor of such rocks.

SLATE QUARRIES.

In reference to the slate quarries of Scotland, one or two only remain to be added to those included in the reports of slate quarries published by the Society last season.

Ballihulish Quarry, in the parish of Lissmore, is occupied

by the proprietors, D. and C. Stewart, Esqrs. This quarry produces a beautiful dark blue slate, nearly free from iron pyrites, so common in the Eisdale and some other slates. The labour of working this quarry is incredibly great, for the chaotic confusion, though a primitive rock, often presents such formidable obstructions to tracing its foliated structure, as to render success occasionally doubtful, if not deceptive. The singular position of the slate, which is generally found on edge, and the immense masses of shale, and quartz blended with it, require the constant and copious use of gunpowder to separate them. The excavations of this quarry are many hundred yards long, and two to three hundred feet deep. The sea flows to the base of the rock, so that vessels sail almost into the quarry, and are loaded with the utmost facility by waggons running on railways. There are about 200 men employed, mostly on piece-work, in squads. The most experienced are alone entrusted with cleaving the slate blocks. This operation is paid for by the 1000 slates produced. The operation is divided into three parts, and performed by different hands. The first cleaves the large blocks into smaller; the second seats himself on the ground, and placing one of these blocks on its edge between his knees, having a chisel about two inches in the face and a small mallet in his hands, gently strikes the chisel into the edge of the block at two or three places along a foliated line of cleavage. The block is thus subdivided into as many slates as there are joints in the piece, that is, to the thickness of two, three, or four eighths of an inch each. The third operator seats himself beside a pile of slates, and having before him a piece of thin-edged iron, six to twelve inches long, and about one-half of that in breadth, fastened into a block of wood, takes up a slate, and holding it horizontally with one edge resting on and projecting about one inch over the edge of the iron, he gently chips off with a kind of cleaver the inequalities along all the edges of the slate. They are chipped to a uniformity of length and breadth by a gauge. The slates are then *sized*,

and counted into separate piles, ready for sale. The wages of the dressers vary from 17s. to 24s. per 1000 slates, according to size; and a good hand will in this way make 12s. to 20s. per week. The present prices are:—Dutches, 24 inches by 12, L. 7; Countess, 20 by 10, L. 4, 10s.; Sizeable, 10 by 6, L. 2, 5s.; Under size, 12s. 7d. per 1000, or rather per 1200, for slates are counted by the long hundred of six scores: 1700 to 2000 of the common slates cover a rood of roof. Annual sales 3,000,000 of slates.

- *Aberfoyl Quarry*, parish of Aberfoyl, rented by Messrs M^rFarlane. This quarry is on the side of a steep mountain, two to three miles beyond the above village, and presents a very fine specimen of clay-slate rock, which appears as if bursting through the side of a trap-rock, from which it assumes an opposite bearing, rising to a conical apex till it forms an angle of 30 or 40 degrees with the slope of the sustaining mountain. The operated part is nearly 200 feet perpendicular, some parts of which have a fine smooth leaden surface, full of straight lines and angled joints, which, when separated, seem solid squares of polished stone, so compact as to require a close inspection to discover their foliated structure; while many others are so brittle as to crumble into pieces when struck. This quarry produces an excellent slate, and is daily extending its operations. Notwithstanding the long land-carriage of twenty miles to Stirling, and fully more to Glasgow, twenty to thirty men are employed, and four horses. About 15,000 slates are prepared each week during the summer months. Present prices are:—Large blue slates, 42s.; large green do., 38s.; small blue do., 16s; smaller do. 10s., per 1000. Annual sales about 500,000 slates.

There is also a good slate of a greenish-blue tint, quarried on a small scale near Comrie, about fifteen miles north of the above, and with an equally distant land-carriage to Perth and Stirling.

The principal clay-slate quarries of Scotland may be classed thus:—1. Eisdale, dark blue slate, hard; 2. Ballihulish, do.

do.; 3. Bute, pale blue, semi-hard; 4. Luss, pale blue, semi-hard; 5. Aberfoyl, blue and green, hard; 6. Foudland, light blue, semi-hard; 7. Huntly, blue and green, semi-hard.

SANDSTONE QUARRIES.

An account of most of the sandstone quarries of the Edinburgh and Glasgow districts having been already furnished, the present narrative is strictly confined to those quarries of the midland counties which have hitherto been entirely overlooked. But as it may be desirable to have an abstract of the whole, so as to obviate as much as possible the inconvenience of these communications being made in this detached form, the annexed table is drawn up to bring the most material points together, and give a more correct idea of the comparative excellence of each quarry.

The specific gravity of the stones is also given, which is perhaps of more importance than builders are in general inclined to attach to it; for extreme lightness is as incompatible with compactness as durability. And with a view of still farther illustrating the subject, and of imparting to practical men a confidence in what is stated of their utility, I may mention, that specimens from these quarries were first carefully weighed in air, then in water, and thereafter put into a close oven, which was heated to about 212° Fahrenheit, when they were taken out and reweighed in air to ascertain how much each had lost by evaporation, or, in other words, how much each would be acted on by the changes of the atmosphere, which will be found to correspond pretty nearly with the variations of their specific gravities. Another mode of ascertaining the quality of sandstone is,—to place a small piece in a common fire; if the stone makes a crackling noise, or flies out, it is bad (too porous), and will not last, while such as do not so are generally good. And on examining the exposed parts of old buildings, it will invariably be found that *waved*, *striated*, or unequal coloured sandstone, is of all others the least durable either on bed or side

ABSTRACT of the Principal Sandstone, Slate, and Greenstone Quarries in Scotland, with their Analysis.

No.	NAME.	COLOUR.	EXTENT.	STRUCTURE.	QUALITY.	1ST PRICE, per Superficial foot.	2D PRICE, per Cubic foot.	Specific gravity.	Loss by heat of 212°.	ANALYSIS. 500 parts combined			
										Carb. of Lime.	Oxide of Iron.	Alumina.	Magnesia.
1	Craigleith	{ Greyish-white and buff }	Great depth	Laminated	Hard	---	---	2.44	1 per cent.	{ 4	2	2	187
2	Redhall	{ do. White and light }	Do.	Chiefly in mass	Soft	---	1s. to 3s.	2.31	2 per cent.	{ 4 5	3	2	186
3	Humbie	{ do. Brown }	Do.	Do.	Semi-hard	---	---	2.26	1½ per cent.	{ 4	2	1	183
4	Binnie	{ do. Brown tint }	Do.	Do.	Soft	---	---	2.25	1½ per cent.	{ 4	2	2	185
5	Hailes	{ do. Dark grey }	Do.	Foliated	Hard	---	---	2.25	1½ per cent.	{ 4	2	2	186
6	Jerusalem	{ do. Whitish grey }	Not so deep	Chiefly in mass	Hard	---	---	2.20	1½ per cent.	{ 4	2	3	179
7	Garscube	{ do. Mottled white }	Great depth	Laminated	Semi-hard	---	9d. to 1s. 6d.	2.35	1½ per cent.	{ 4	2	1	186
8	Balgray	{ do. Glancing white }	Extensive	Stratified	Hard	---	1s. to 2s.	2.35	1½ per cent.	{ 4	2	2	167
9	Woodside	{ do. White and yellow }	Do.	Much stratified	Semi-hard	---	---	2.38	1½ per cent.	{ 4	2	1	187
10	Nisshill	{ do. White }	Very extensive	Partly laminated	Hard	---	10d. to 2s. 8d.	2.40	1½ per cent.	{ 4	2	2	186
11	Westmuir	{ do. Reddish-grey }	Not so	Laminated	Semi-hard	---	---	2.36	1½ per cent.	{ 4	2	1	185
12	Culleo	{ do. White and buff }	Large	In mass	Not hard	---	---	2.28	1½ per cent.	{ 4	2	2	188
13	Dulloch	{ do. Whitish-grey }	Very large	Foliated	Hard	---	6d. to 1s.	2.30	1 per cent.	{ 4	2	2	186
14	Mylnfield	{ do. Greenish-grey }	Great depth	Laminated	Hard	---	9d. to 1s. 9d.	2.49	1 per cent.	{ 4	2	8	163
15	Lochee	{ do. Reddish-grey }	Do.	Do.	Hard	---	9d. to 1s. 9d.	2.52	1 per cent.	{ 4	2	9	160
16	Carmyle	{ do. Dark grey }	Not deep	Foliated	Very hard	---	---	2.48	1 per cent.	{ 4	2	2	154
17	Lecys	{ do. Greenish-brown }	Do.	Do.	Semi-hard	---	---	2.50	1 per cent.	{ 4	2	3	149
18	Giffnock	{ do. White }	Great depth	Stratified	Do.	---	5d. to 1s.	---	---	{ 4	2	4	174
19	Do. new	{ do. Do. }	Do.	Do.	Do.	---	6d. to 1s. 2d.	---	---	{ 4	2	4	174
20	Craigannet	{ do. Do. }	Do.	Do.	Do.	---	6d. to 1s.	---	---	{ 4	2	1	190
21	Catfiness flag	{ do. Deep blue }	Not deep	Chiefly in mass	Hard	---	---	---	---	{ 4	2	10	128
22	Eastwood flag	{ do. Greyish-white }	Extensive	Foliated	Very hard	---	---	---	---	{ 4	2	4	176
23	Stirling green- stone	{ do. Greenish-white }	Do.	Do.	Hard	---	6d.	---	---	{ 4	2	6	7
24	Queensferry do.	{ do. Do. }	Do.	In mass	Very hard	8d. per ton.	10d.	2.83	---	{ 4	2	34	4
25	Esdsale slate	{ do. Dark blue }	Do.	Columnar	Do.	8d. per ton.	1s.	2.85	---	{ 4	2	34	4
26	Ballinulish slate	{ do. Do. }	Do.	Foliated	Semi-hard	---	---	2.78	---	{ 4	2	34	4
				Do.	Do.	---	---	---	---	{ 4	2	36	5
						---	---	---	---	{ 4	2	36	5

East Lothian Quarries.—There are not any extensive sandstone quarries in East Lothian. The *Dunbar* quarries produce a stone of a dull dingy red colour, not very pleasing to the eye, and of doubtful durability, if an opinion may be formed from the appearance of the new parish church, some of the stones of which already show symptoms of decay, and evidently are far inferior to the fine body of old red sandstone along the beach and harbour, with its beautiful columns, held together by quartz-spar, and from which the imperishable walls of the castle are built.

Jerusalem Quarry, parish of Pencaitland, rented by Mr Guthrie, is, however, worthy of notice, both from its antiquity and the quality of the stone. This is a greyish-white laminated rock, about sixteen feet column, with an upper strata of two or three feet of very hard sandstone and limestone combined, chiefly used in road-making and rubble buildings. Dip slightly south. Blocks can be obtained in this quarry twenty to thirty feet long, uniform in colour and solidity. The Haddington town-house and the county buildings, just finished, are of this stone; and the venerable cathedral is said to be of the same material. An expensive and still very efficient level has at a remote period been cut through a very broad bank, and carries off the pit water: ten men are employed at 12s. per week. The price of stones are,—Cubes, 9d. per foot; rye-bates and ashlers, 7 inches to 8 inches at the least part, 4½d. per superficial foot; rubble stone, 1s. per cart. Another opening was lately made in the same bed of rock near Tranent, and several cargoes of the stone sent to London.

The next undescribed quarry near these is *Redhall*, parish of Colinton, occupied by the proprietor, John Inglis, Esq. This rock is of unknown depth, with about 200 yards of open front, upwards of 100 perpendicular in one solid mass, exclusive of 10 feet to 30 feet of tiring: dip 20° north-west. This stone, from its low bed and load of incumbent soil, is soft when first removed, which renders it very fit for the chisel and delicate carving, and the more so as it hardens on ex-

posure to the atmosphere and retains its polish long. It is chiefly in mass, partly of a dull white and deep buff colour; termed *liver-stone*, both of which are got in blocks of immense size. Fifteen men are employed at 12s. per week. The stones are loaded by the aid of cranes, and conveyed on an inclined plane to the verge of the Union Canal, which literally passes through the quarry. A steam-engine impels these waggons, and also withdraws the pit-water from the quarry; and so considerable were the operations carried on here a year or two ago, that the annual rent paid by the tenant, now removed to Craigleith Quarry, was L. 1100 per annum. The Roman Catholic chapel lately built in Lothian Street is a good specimen of this quarry. The present prices are: Common rock—ashler, 4d. per cubic foot; rybates, 6d. each; 5 feet stones, 2s. 4d. do.; 7 feet stones, 4s. 8d. do.; 10 feet stones, 10s. do.; rubble, 6d. per cart. Liver-rock,—ashler, 6d. per superficial foot; rybates, 1s. each; 5 feet stones, 4s. each; 7 feet stones, 10s. 6d. do.; 10 feet stones, 21s. do.; cubes under 5 feet, 1s. 3d.; do. 10 feet, 1s. 6d.; do. 20 feet, 2s. 6d.; do. 30 feet, 3s. per foot. Common stone cubes about one-half of these prices.

Renfrewshire Quarries.—In the Glasgow district is *Nits-hill* quarry, in the Abbey Parish of Paisley, rented by Mr Hosie. This fine white sandstone has almost no tiring whatever. The rock is about 80 feet deep, in plates of 7 inches and 7 feet thick; dip slightly south-east. Blocks of every possible size are cut by wedges inserted in small indentations, made with pick-axes, along the intended line of cleavage, and no gunpowder is used, nor ought it to be used in a quarry whose stones are intended to be dressed for building, as they are apt to be injured or shaken by the explosion. One hundred men are employed at 10s. to 12s. per week. The stones are moved about the quarry in waggons, pushed by one or two men, on railways, and laid on carts by cranes of great power. A steam-engine moves the pit water-pumps. The sales are chiefly to Paisley and Glasgow, from which towns

the quarry is nearly equidistant by the canal. Present prices are : Rubble, per ton, 1s. 6d. ; rybates, 24 inches by 12, 7½d. ; pavement, 30 inches by 18, and 4 inches thick, 1s. ; ashler, 5d. per superficial foot ; cubes, under 5 feet, 10d. per foot ; under 10 feet, 1s. ; 20 feet, 1s. 10d. ; 30 feet, 2s. 8d.

Giffnock Quarry, Eastwood parish. Rented by Samuel Hosie. Fine white rock, yielding blocks of great size. Level freed by a syphon pump. Fifty men employed, at 2s. to 2s. 6d. per day.

Prices : Cubes, 5 feet to 10 feet, 5d. per foot ; 10 feet to 16 feet, 6d. ; 16 feet to 24 feet, 8d. ; 24 feet to 30 feet, 9d. ; above 30 feet, 1s. per foot. Lintels, 4 feet long, 1s. 2d. ; 5 feet, 1s. 8d. ; 6 feet, 2s. 6d. ; 7 feet, 3s. 6d. ; 8 feet, 5s. each. Ashler, 4d. ; and rybates in proportion. Rubble, 4d. per cart.

Giffnock New Quarry, same parish, and a separate working of the above rock. Rented by Mr Willox ; also drained by a syphon-pump. Forty men are employed, at 12s. to 15s. per week.

Prices : Cubes, 5 feet to 10 feet, 6d. per foot ; 10 feet to 16 feet, 7d. ; 16 feet to 24 feet, 9d. ; 24 feet to 30 feet, 10d. ; above 30 feet, 1s. 2d. per foot. Ashler, 4d. Lintels, 4 feet, 1s. 3d. ; 5 feet, 1s. 10d. ; 6 feet, 2s. 8d. ; 7 feet, 3s. 8d. ; 8 feet, 5s. each ; and rybates in proportion. Rubble, 5d. per cart.

Eastwood Pavement Quarry, Eastwood parish, rented by Mr Willox. A fine formation of foliated sandstone, 50 feet deep, in beds of 2 inches to 2 feet thick ; hard, and of great breadth. Sixty men are employed, at 12s. to 15s. per week ; and the underwater drawn off by a steam-engine.

Prices : Under 3 inches thick, 1s. 6d. per yard ; 3 inches to 5 inches, 1s. 8d. ; 6 inches, 3d. per square foot ; 7 inches and upwards, 4d. Blocks, 6d. per cube foot. Cartage to Glasgow, 3½ miles from the last named three quarries, is 2s. per ton.

Nithsdale Quarries.—In Nithsdale district are—

Newton Sandstone Quarry, parish of Closeburn ; rented by Messrs Muirhead and Co. This rock is in plates of ½th

of an inch to 6 feet thick ; of a deep red colour ; soft, and easily dressed. The under beds are very compact, and are occasionally cut into blocks of large dimensions. Dip 10 degrees north.

The sales are chiefly confined to pavement and roofing slates. Twenty men are employed, at 6d. per cubic yard quarried, including tiring, which is trifling. Present prices are : Common ashler, 2d. per superficial foot ; lintels, 3d. if above 5 feet ; and under 7 feet, 4d. ; 7 feet to 9 feet, 5d. ; 9 feet to 12 feet, 6d. ; all above, 9d. per superficial foot. Cubes, not above 6 inches, 4d. ; not above 12 inches, 5d. ; not above 20 inches, 6d. per foot. Pavement, 7d. per square yard. Roofing-slates, 20 inches square, 2d. each.

Kitlawbridge Quarry, Glenluce parish ; rented by Mr Tennant. This quarry is very near the above, and is of similar formation and colour. There is a front of nearly 100 perpendicular feet. Dip slightly north-east. Twenty men are employed, at 10s. to 12s. per week. Prices the same as the above.

These quarries produce great quantities of pavement and roofing slates, but the colour is gloomy, and the slates apt to give way, yet both objections might be greatly modified by painting the roof of a deep blue colour, which would add to its appearance, and preserve the slate.* Twenty of these slates will cover $6\frac{1}{4}$ yards, or 100 will serve for a rood.

Vale of Forth Quarries.—To return to the Vale of Forth, the whole north bank of that river from Aberdour in Fife to Tullibody in Clackmannanshire is one continuous bed of the same sandstone, which is partially quarried at both these places, as well as at Alloa, Longannet, once a celebrated quarry, Sands, and Blair ; and, passing them the next is

Duloch Quarry, parish of Inverkeithing ; occupied by the proprietor, John Cunninghame, Esq. This stone is whitish-grey, hard, and foliated, in beds of 2 inches to 40 inches in

* Coal-tar has been used for this purpose, and it prevents the rain-water penetrating the slate for many years.—Ed.

thickness ; the under part is cut in blocks of great length and solidity, and used in building ; the other beds are chiefly used for lintels, stairs, and pavement. Dip 20 degrees south-east. Fifty men are employed at 10s. per week, and 4 horses ; the tiring, about 15 feet, is let at 5½d. per cubic yard.

The quarry is level free, and the stones are conveyed on rails and one-horse waggons to the ship side. The present working is about 18 feet of rock, with 20 feet of excellent stone still lower untouched.

Prices : Land sale, common ashler, 3d. per foot ; rybates and corners, 6d. each ; stones from 1 ton to 2 tons, 6d. per cubic foot ; rubble stones, 4d. to 6d. per cart. Shipping prices, rubble 1s. per ton ; all the others ¾d. extra when shipped. In the course of last season, upwards of 120 vessels of 50 tons each were loaded from this quarry

Basin of Tay Quarries.—*Mylnefield Quarry*, parish of Longforgan ; rented by Messrs Wilkie and Co. This extensive quarry is almost within the tide-mark on the north bank of Tay. The stone is hard, and of a greenish-grey colour, of great strength and solidity, and much used in harbours and public buildings. Great quantities are annually shipped to distant places. The clear depth of the present working is about 40 feet in laminæ of 4 inches to 6 feet each, without a flaw. Dip slightly south or seaward. The whole is quarried by pick and wedge. Sixty men are employed, at 10s. to 14s. per week.

Prices : Picked rubble, per ton, 2s. 3d. ; common do. 1s. 8d. ; ashler, 10 inches by 6, and 8 inches thick, 4d. per lineal foot ; heavier, do. do. 7d. per do. ; stones 5 feet by 3 feet and 8 inches thick, 10d. per do. ; stones 3 feet to 4 feet by 2 feet and 1½ feet thick, 9d. per cubic foot ; steps, 4½ feet by 14 inches and 8½ thick, 3s. 10d. ; other sizes in proportion.

Upwards of 8000 tons of stones were shipped from this quarry last season. The stones are loaded by cranes, and

conveyed on board in waggons on rails. A powerful engine preserves the level of the quarry.

Lochee Quarry, parish of Liff and Benvie; rented by Mr Stewart. The front is about 80 feet of laminated stone of the same colour and quality as the above, and conducted on the same principles. Sixty men are employed at 11s. to 13s. per week. These stones are also used in the Dundee New Docks.

Prices: Common ashler, 6d. per superficial foot; parapets, 1s. each; lintels and soles, 4 feet by 15 inches, and 7 inches thick, 2s. each; do. 6 feet by 15 inches, 3s. 9d.; rubble stone, 9d. per ton; cube stones, of any size, at 1s. per foot; stones not prepared, 8d. per ton if not more than one-half ton each. Carriage to Dundee, three miles, 1s. 8d. for 25 cwt.

Upwards of 4000 tons of dressed stones were sold last season, exclusive of rubble stones. A steam-engine and inclined rails are here also employed.

Forfar Quarry, Forfar parish; rented by Mr Copland. This quarry has an immense accumulation of waste, there being a tiring of 21 feet of soil, then 12 feet of shale, overlying about 6 feet of foliated rock, which is again sustained by 14 feet of shale, under which other 6 feet of superior pavement occurs. This is almost wholly a pavement quarry, with a few heavy slates, tolerably hard, of a greenish-grey colour. Thirty men are employed, at 11s. per week, except when tiring, which costs 8d. per cubic yard.

Prices: Common pavement, on board at Arbroath (nine miles), L.14 per 1000 superficial feet; 3 inches do. L.16 per do.; under size, L.9 per do.; roofing slates, L.4 per 1000, $3\frac{1}{2}$ long hundreds make 36 square yards of roof. No machinery is used.

The original quarry for the Arbroath pavement is situated behind Panmure, a barren waste, which probably derived this appropriate name from the fact of the thin incrustation of the foliated stone cropping out in every direction. There are numerous openings in the rock, the oldest of which is *Car-*

mylic, in the parish of Carmylie. The dip leans a few degrees north-east, with a tiring of 2 feet to 8 feet of soil, and 3 feet to 10 feet of shale. The pavement bed is 5 feet to 7 feet thick, in plates of 1 inch to 9 inches each, and which may be cut at any required length, by several feet in breadth. Some flags have been taken out 60 feet long, raised entirely by crow-bars and mattocks; and large plates have been sent to London, France, and America. The stone is very hard, and of a greenish-brown colour. Sixty men are employed, some at 10s. to 12s. per week, and others at L.4 to L.6 per 1000 feet lineal measure of pavement prepared, including tiring. All the stones are squared to uniform dimensions before being sold.

The prices on board at Arbroath, seven miles off, are : Common pavement, $1\frac{1}{2}$ to 3 or 4 inches thick, L.15 per 1000 lineal feet ; under size do. L.11 to L.12 do ; extra size do., not exceeding 20 lineal feet each flag, 9d. per lineal foot ; 20 feet and upwards, 1s. per do. Stair-steps, 4 feet to 6 feet long by 7 inches to 8 inches thick, and 14 to 15 inches broad, 1s. 2d. to 1s. 3d. per do. ; not exceeding 10 feet long, 1s. 8d. per do. ; intermediate and extra sizes in proportion. Quarry price for roof slates L.4, 10s. per 1000, of 15 to 20 inches by 9 to 12 inches each, $3\frac{1}{2}$ hundreds computed to cover 1 rood of roof. Home sale : Common pavement. 2d. to $2\frac{1}{2}$ d. per lineal foot ; inferior do. $1\frac{1}{2}$ d. per do. ; stair, and similar sizes, 6d. per do. under the shipping price. There are seven windmills, of one-horse-power each, to draw off the pit-water from the various quarries : each mill cost L. 30.

Leys Quarry, parish of Inverkeillor ; occupied by W. F. Lindsay Carnegie, Esq. of Kinblethmont. This quarry has only been about two years opened. The plates are, in bed, about 6 to 10 feet thick, and 2 to 12 inches each. Dip 15 degrees south-east ; with 6 to 20 feet of tiring. The stone is inferior, and the colour greenish-grey. The only interest attached to this quarry is, the mode of dressing the pave-

ment with a machine, which is not less novel than simple, ingenious, and original. I shall not enlarge on the utility of this machine, as it has been already particularly figured and described by Mr Carnegie himself, in vol. xi. p. 160. of the Society's Transactions.

Caithness Flags.—*Castleton Quarry*, Thurso parish, worked by the proprietor James Traill, Esq. of Ratter House.

This stone is of a dark blue colour, much harder than the Arbroath pavement, which often hinders architects under common contracts from using it. The bed is upwards of 8 feet thick; dip slightly north or seaward, intersected by numerous cross joints, and perpendicular backs, affording flags of great length and breadth, varying in thickness from 4 inches to $\frac{1}{4}$ th inch each: with a tiring of 6 to 9 feet of clay and shale. The thin or roofing slate found on the top gradually increases in thickness as the rock recedes from the surface.

To obviate the difficulty of chisel-dressing, the flags are now completely prepared for laying at the quarry by a very simple process, namely, by rubbing one piece on another,—one, two, or more flags, according to size, are laid on a slightly inclined bench or table about 2 feet from the ground, the other flag being fastened to a pole about 7 feet long by means of a sliding-hook at each end. A man takes hold of the pole, and commences a parallel motion, by alternately pushing and pulling the upper stone or *runner* to and fro, coarse sand and water being meanwhile introduced between the flags as in marble-cutting. After the runner is thus partially polished, it is laid aside and replaced by a new one; the operation then proceeds as before, till the under slabs assume the same smoothness as the upper one; the first runner is then returned, and the polishing recommences with finer sand, but is finished with water alone. The flags are *squared* or edge-cut by a saw worked by one man, and formed of sheet-iron about 9 feet long by 8 inches broad, with a back $1\frac{1}{2}$ inches deep by $\frac{1}{2}$ inch thick, bolt fastened; there are three teeth or

indentations cut in the saw 1 inch long by $1\frac{1}{2}$ inches deep. This operation is also performed with sand and water. These men are paid $1\frac{1}{2}$ d. per superficial foot of flag polished; and the quarry men have 1s. 6d. to 2s. per day; about 100 men and 8 horses are employed.

The under water of the quarry is drawn off by windmills. The roofing slates are sold at L. 3 per 1000 mixed, in sizes from 30 to 18 inches long, by 15 to 6 inches broad; and $1\frac{1}{2}$ inch flags, 1s. 2d. per square yard. The chief sales are to London, Liverpool, Glasgow, and Leith, to which the flags are conveyed at 1d. to 2d. per superficial foot, and are sold in Edinburgh, 1 to $1\frac{3}{4}$ inches thick at $4\frac{1}{2}$ d.; $1\frac{3}{4}$ to $2\frac{1}{4}$ inches thick, $5\frac{1}{4}$ d.; $2\frac{1}{4}$ to 3 inches thick, $6\frac{3}{4}$ d.; 3 to 4 inches thick 9d. per superficial foot. A similar quarry is opened by Lord Duffus near Wick, but not so extensively worked.

GREENSTONE QUARRIES.

The principal greenstone quarries are at *South Queensferry*, parish of Inverkeithing, rented by Mr Mathieson. This rock presents a front of 100 feet perpendicular, in a columnar form, resting on sandstone. These immense blocks are placed on end, with a slighter inclination north at the top, and, like all similar formations, seem to hang by one another without being united, as a few strokes of the crow-bar, or a very small charge of gunpowder inserted at the points of contact, generally brings down a column 20 to 70 feet by 2, 3, or more feet in the side, without a flaw or fracture, every part appearing a smooth natural surface. These are again cut to any required size by means of a line of steel-edged wedges inserted in the stone, and alternately struck with large hammers; each block is then dressed, first, with sharp-pointed thick *picks* of 15 lb. to 20 lb. weight, 18 inches long, and 3 inches in the side at the centre; then with pick-axes of a lighter form; and then finished at the points or edges with a *cold* chisel and mash hammer 6 lb. weight, which gives the whole a surface similar

to a neat *droved* sandstone. Fine specimens of this workmanship and stone are seen in Stirling new bridge, many of them being 3 to 7 feet long by $1\frac{1}{2}$ to 3 feet in the side, and cost about 1s. per cubic foot on board. The same stone is also extensively used in causeways. These are dressed to various sizes, say 8 to 9 inches in the top, and 9 to 14 inches long, at 8s. per ton on board. In paving, these stones are placed on end in lines or rows, and 1 ton will pave $2\frac{1}{2}$ square yards, other sizes in proportion. And if made into road metal of the usual size, 1 cubic foot will weigh 1 cwt., and 20 cwt. cost 4s. or 4s. 3d. in the quarry. There are some coarser portions of this rock which are fire-proof, and occasionally used for bakers' ovens.

Stirling quarry, parish of Stirling, rented by Messrs Hollis and Oatc. This rock forms the curvilinear boundary of the Gowan Hills on the south-west and north-east sides. A bold range of stately columns sustain the walls and ramparts of the castle. The quarry is at the north-east angle of the hill, and has a perpendicular front of about 60 feet of solid rock, but being worked from this side, which is in opposition to the lie of the rock, it presents a very rugged and uneven fracture, and, except when a back or similar joint occurs, there are hardly any stones found fit for dressing, and the whole are chiefly used for rubble walls and road metal. This stone is removed entirely by bore and blast, which is performed thus: A set of steel rods about 1 inch diameter, and 1 to 3 or more feet long, and slightly flattened at the one end into a half round face a little larger than the other parts of the rod, the other end being cut straight. This rod is held in the left hand, with the flat end placed on the rock where the perforation is to be made, and struck with a mash hammer at regular intervals, while the operator keeps grasping or renewing his hold of the rod, and ultimately twisting it one-half round from right to left between every stroke; and having penetrated an

inch or so, he then pours a little water into the hole, and passing the rod through a flange formed of straw or grass which rests on the orifice of the bore and prevents the water from squirting out on striking the rod, the operation then proceeds, and a little water is regularly added to expedite the work and movements of the *jumper*, which is still in reverse motion as before, so as to preserve the uniformity of the bore. When the desired depth is attained, 15 inches to 30 inches, the bore is cleaned out and dried with a bit of rag placed on the bent end of a small iron rod; the gunpowder is then introduced, and the space filled to within a few inches of the top; a small iron rod is then placed at one side resting on the gunpowder, and the remainder of the bore stemmed full of chips from the stone; the small rod or needle at the side is then withdrawn, and its place filled with gunpowder, the match applied and the whole explodes. These bores are sometimes made several inches diameter and many feet deep with increased success. It is here proper to state that many fatal accidents have been occasioned by stemming the charge, in this mode of quarrying, with fragments of the hard rock, which are apt to give out sparks of fire, while being beat down by the jumper, and ignite the powder while the operator necessarily sits on the top of the bore: copper rods have therefore been suggested as less dangerous rammers. But the precaution is objectionable and unnecessary, because a more expeditious, equally efficient, and perfectly safe method is always within the reach of every quarrier, namely, by using pure clay, loamy soil, or fine sand alone. Nor is this mere theory, the fact has been tested by myself, and may be demonstrated by any one choosing to make the trial. All that is necessary is to exclude the inflammable material below from the access of the atmosphere above, first, by placing a little wadding of dry grass or moss (fog), next the powder, and then filling up the bore with moderately moist clay, soil, or sand well packed to the orifice, leaving the needle placed at the side to form the train

in the usual manner, which may either consist of a straw reed or a tin tube ; and where the clay is good, and the needle cautiously withdrawn, the powder may be poured in without any envelop, only gently probing the aperture with a small wire to condense the train. Clay being the compactest is obviously the most eligible stemming, as it can be easily withdrawn, or a new train instantly perforated by one probe of the needle, and the first train closed up in the event of its missing fire, instead of losing the whole or adopting the present hazardous practice of re-working a stone-stemmed bore. Should it at any time be found impossible to remove the water entirely from the bottom of deep bores, and no tin case at hand, the charge may be introduced in a cartridge made of well-greased coarse paper.

About twenty quarriers are employed at this quarry, and often twice that number of stone-breakers, the former at 9s. to 12s. per week, and the latter at 1s. 6d. to 2s. 6d. per cubic yard of road metal, each piece of which must pass through a ring of $1\frac{1}{2}$ to $2\frac{1}{4}$ inches diameter as may be agreed on. It requires a very expert hand to break a cubic yard of the smallest size in one day. But it is important to observe that road metal broken on the loose heap is much preferable to that broken on slabs, the former being simply chipped piece from piece with a small hammer, each piece remaining free of internal fracture ; whereas that smashed to bits on a stone table by a heavy hammer is fractured throughout by the resistance of the stone, and crumbles into dust almost as soon as laid on the highway. Average sales, 2000 carts of rubble stones at 8d., and 3000 yards of metal at 2s. per cubic yard ; dressed pavement stones at 3s. to 5s. per square yard.

A similar quarry is carried on at Abbey Craig, about two miles north-east of the above, but the present operations are limited to road-metal only.

ON THE GEOLOGY OF MORAYSHIRE. *By Mr JOHN MARTIN,
Elgin.*

[The Society's Gold Medal was awarded for this Essay.]

I. PHYSICAL GEOGRAPHY.

MORAYSHIRE, or Elginshire as it is sometimes called, from the name of its principal town, is a county formed out of part of the ancient province of Moray. It is bounded on the north by the Moray Frith, on the east and south-east by Banffshire, on the south and south-west by Inverness-shire, and on the west by Nairnshire. It is about twenty-five miles in length, and twenty-two in breadth, and contains an area of 400 square miles. It is naturally divided into two distinct portions, the hill and the plain, the latter extending from the Spey to the western boundaries of Nairn, and from the shores of the Moray Frith to the bottom of the range of hills on the south, a distance varying in breadth from six to twelve miles. This plain is agreeably diversified, by low, gently sloping hills, running parallel to the shore. It is all arable, with the exception of wood, and a low tract composed of sand and shingle, which skirts along the shore. The hilly part extends south of the plain to the southernmost parts of the parishes of Knockando, Dollas, and Edinkillie, and east and west, from the Spey to a line a little west of the Findhorn. The hills are not remarkable for eminence, neither do they present that broken and abrupt outline which generally characterizes primitive mountains, their outlines being rounded and unbroken, and their declivities, in many places, capable of being cultivated to the summits.

These two divisions are frequently denominated Highlands and Lowlands; the latter is, however, more frequently designated by the homely title of "The Laigh o' Moray," which is very significant of the distinction between the two divisions.

The plain, or Laigh o' Moray, forms the shore, and, throughout its whole extent, sandstone presents itself, in some places at the lowest level that has been reached, and in others in low ridges that traverse the county from west to east. These ridges give an agreeable diversity to the landscape, while their smooth and regular outlines harmonize with the nature of the plain. The northernmost ridge skirts the shore of the Frith, from Lossiemouth to Burghhead, a distance of nine miles, presenting a bold and precipitous front to the sea. Another ridge intersects the middle of the plain, and is separated from the former by the hollow which had formed the basin of the lake of Spynie. It extends from Alves to Pitgavenie, a distance of seven and a-half miles. Other ridges of inferior height traverse the county in the same direction, in some places superimposed by a thick bed of limestone. Over the whole plain are striking manifestations of the action of water; and undoubtedly oceanic currents had, in an early age, swept over the plain of Moray.

The Highlands constitute the southern part of the county, and is composed of a series of hills, rising higher and higher as they approach the interior. They extend in unconnected masses, nearly west to east; and, in general, have their steeper declivities on the south. They are composed of gneiss, covered with an immense thickness of diluvium. The mountain masses are divided by numerous valleys, which form channels for the many streams which traverse the county. The rivers Spey, Lossie, and Findhorn, drain the county, and they all appear to have effected considerable alterations in the formations through which they flow. The Spey is on the eastern confines of Morayshire. It rises from a small lake called Loch Spey, near Badenoch and Glenroy, and after running a course of ninety miles, falls into the Moray Frith at Garmouth. The extent of surface from which it derives its waters is 1300 square miles. After traversing eighty miles of primitive country, it enters on the eastern edge of the plain, which here presents a monotonous character over an extent of

ten miles. It is probable that, in a remote age, it had pursued a different direction in the lower part of its course, from what it does at present ; and, although both history and tradition are silent on the subject, its ancient channel can be distinctly traced, through the Glen of Rothes, in the direction of Elgin. It is not a navigable river, but is a valuable medium for conveying the timber of the Highland forests to the port of Garmouth. One great object of importance, connected with it, are its fisheries, which afford an annual rental of L.8000.

The Lossie has its source among the hills of Edinkillie. At a former period it had undoubtedly flowed easterly, through the lower part of the parish of Birnie, where its ancient channel is distinctly traced, from the Foss to the Level and Linkwood. Its present course is northerly of the Foss, over an extensive plain, to the north of Elgin, till it reaches Forrester Seat, whence it flows northerly to Lossiemouth, where it is lost in the Moray Frith.

The Findhorn rises among the Monagh Lea Mountains, in Inverness-shire. It enters upon the county of Moray to the south-west of Relugas, where it is augmented by the junction of the Divie and the Dorbeck. Lower down at Sluie it enters the plain, through which it winds its way northward, until it empties itself into the sea at Findhorn.

II. GEOLOGY.

The geological structure of this district cannot be accurately investigated, because of the difficulty of the rocky strata being deeply covered with an immense mass of diluvium. In many places, however, the rocks display their edges, which gives a clue to their position, and their relative connection with one another. The district is occupied by rocks which have been deposited by water, in the form of strata, inclining more or less to the horizon, and succeeding one another in a certain order of superposition. It is evident that some of the strata have experienced considerable displacement by the

denuding action of water, so that only fragmentary portions of certain rocks remain, which had no doubt previously extended, in a stratified form, over a great part of the plain. The red sandstone, for instance, on the banks of the Spey, displays but a narrow ridge, about a mile in length. This ridge is, undoubtedly, an outlying portion of a very extensive deposit, which, in all likelihood, formed a connection with a lesser ridge lying about nine miles to the eastward. In both situations the rocks shew an identity of character, and the intermediate parts appear to have been torn up and carried away, and replaced by an accumulation of diluvium. The limestone rock has probably experienced a similar disruption, but to what extent cannot be easily ascertained, disintegrated parts of it being found, with portions of the yellow sandstone, scattered over the country to a great distance.

Before proceeding to a description of the different rocks, we shall give a classification of them in their order of superposition, commencing with the uppermost or newest deposit.

Formations.	Mineralogical character.	Remarks.	Localities.
ALLUVIAL DEPOSITES.			
ALLUVIUM.	Clay, sand, and gravel.	Trunks of trees.	{ In the valleys, and banks of rivers.
	Peat, and submarine forests.	{ Trunks, roots, branches, and leaves of trees.	Bay of Bughhead, &c.
	Sand and gravel, drifted inland from the sea-shore.	Beds of shells.	Seashore.
DILUVIUM.	{ Clay, loam, gravel, and boulders.		
SECONDARY FORMATIONS.			
LIMESTONE.	Bluish limestone.	{ Calcareous spar, crystals of quartz, galena, and blue marl.	Boar's Head, Innes, Meft, Waulkmill, Tradesmoor, Main, Inverugie, Cothall.
SANDSTONE.	Yellow sandstone.	Fullers' earth.	{ Covesea, Quarrywood, Cothall, Pluscardine, &c.
PRIMARY FORMATIONS.			
GNEISS.	{ Grey gneiss associated with porphyry and mica slate.		{ Sluie, Relugas, Rothes, Dollas, &c.

It would have been perhaps proper to have included the lias and red sandstone strata in this arrangement, but as their remains are so limited they have been excluded. It will be here necessary to explain the colouring of the map to understand the localities and relative positions of the rocks. The map conveys a general idea of the geological structure of Morayshire. It would have, perhaps, been more to the purpose to have continued the yellow colouring, representing the great sandstone deposit, over the whole of the plain, as it is evident from various sections that it pervades the whole lower division. There are certain overlying deposits, however, which abound to a great extent, and it has been considered of importance to represent them in their proper places. The higher division is coloured red, and is intended to represent gneiss. Although little of this rock is seen from the immense diluvial accumulations which cover it, yet its appearance in certain localities makes it probable that it pervades the whole upper division. The limestone is coloured blue, the alluvium green, the diluvium brown, and the old red sandstone red.

I. ALLUVIUM.—Under this term are classed those accumulations of clay, sand, earth, and gravel, and other materials brought down by the passage of running water, or deposited by the action of the waves of the sea. It will be observed, that the deposits in question are effects of agents which are still in active operation, such as the chemical effects of the air, the physical effects of wind, and the physical effects of water, whether depositions and abrasions from rivers or the sea.

1. *Sedimentary Deposites.*—It is evident that rivers, whether in their swoln or common state, operate more or less upon the materials over which they pass, the water being sometimes fraught with minute portions of the materials, and are either

deposited on the bed of the river, on the low-lying meadows and marshes along its banks, or carried out to sea.

Prior to the date of the present improved state of agriculture, the inundations of the Lossie proved very destructive, oftentimes changing its channel, and carrying away the soil of the lowlands into the sea; but now a substantial embankment extends on both sides of the river, from Main to Inchbroom, a distance of ten miles, following the course of the river; and, except in times of extraordinary floods, little danger may now be apprehended from it.

The lake deposits, in this part of the country, are formed from the mechanical admixture of sand and clay, and vegetable remains. The Lake of Spynie had, at a distant period, formed an arm of the sea, and as soon as its connexion with it had been interrupted by the immense accumulation of shingle on the east shore, lacustrine deposits had taken place. Although no river or stream of any importance now runs into the lake, yet formerly the Lossie on the east, and the Findhorn on the west, both had augmented its waters, and it is to their united efforts that must be ascribed the origin of the extensive clay deposit which had extended over its basin, and which has now become in many places productive soil. About the commencement of the nineteenth century the lake extended to about 3000 acres. A canal had been subsequently cut from it to the sea, by which its waters had been greatly diminished. There is still, however, a portion of the east end under water, and its neighbourhood has been converted into a marsh. In 1829, the year of the "Moray Flood," the Lossie broke down its embankments and entered the lake from the east, inundating a great space of the cultivated land. There are no traces of shells in this clay, but immediately under it, and on the bottom of the ancient sea, are immense beds of marine testacea, similar in their characters to existing species.

2. *Peat, Subterranean and Submarine Forests.*—In this

section are arranged those extraordinary deposits of vegetable remains which occur, both in the land and under the sea. These remains have hitherto attracted very little attention in this part of the country, owing, no doubt, to the vast accumulation of alluvium which covers them, and prevents them being correctly investigated. In particular localities, however, vegetable deposits present themselves, and thus opportunities have occurred to point out their situation and extent.

At Burghhead, about nine miles from Elgin, part of a submarine forest has been laid bare. It extends a considerable distance under the sea, and vessels of any burden may sail for depth of water above it.

After a storm, large masses of peat have been raised from their original position and drifted on shore, and trunks of trees, upwards of ten feet in length and four feet in circumference, found on the beach. A large mass of drifted peat is at present exposed on the beach, upwards of twenty feet in length and two feet in thickness; trunks of trees and large branches being imbedded in it. If this portion may be taken as a specimen of the vast accumulation of vegetable remains extending over the district, it may serve the purpose to mention the variety of trees in it to convey some idea of the composition of the whole. The trees are chiefly oak, birch, alder, hazel, and fir, with the leaves of these matted thickly together, enclosing portions of bark, with hazel-nuts. In some places the vegetable remains are so much decomposed, that not a single vestige of vegetable can be discovered, while, in the same mass, at a short distance, leaves and branches appear quite distinct. No remains of animals have as yet been discovered in this deposit; but as it exhibits an identity of character with those in which the remains of mammalia have been found in other places, it is not unlikely they may yet be found in it.

That an extensive forest existed in this district, these me-

morials are incontestable proofs, and history is not silent on the subject of a terrible inundation of the ocean, carrying destruction into the country, overwhelming villages, castles, towns, and extensive woods. "The death of Malcolm," says Boethius, "happened on the ides of October, in the year of our Redemption 1097, and in the thirty-seventh year of his reign; and in the same year Albion was terrified by many most alarming prodigies: many villages, castles, towns, and extensive woods, both in England and in Scotland, were overwhelmed by an inundation of the German Ocean. By the weight of which tempest, the lands of Godowine, near the mouth of the Thames, were overwhelmed by sand; and likewise the land of Moray, in Scotland, was at that time desolated by the sea; castles subverted from the foundation, some towns destroyed, and the labours of men laid waste by the discharge of sand from the sea: monstrous thunders, also, roaring horrible and vast."

History, we thus see, has not failed to record the great convulsions which took place upon this coast in a distant age, but tradition also appears to have preserved many minutiae of the existence of great forests; for it is related that the inhabitants were compelled by the Danes to carry oak from the valley near Roseisle to build their ships at Burghhead. It is likewise stated that a ship had been manned from Burghhead for the purpose of bringing wood from Norway to this county, in consequence of the destruction of a large wood in which the people used to herd their cows and sheep.

In some places, shingle upwards of twenty feet in thickness covers these vegetable remains, and over it has been drifted sand, forming hills of ten to twenty feet in height. At Haughland, about a mile south-west from Elgin, a very interesting bed of peat has been discovered. It is ten feet in thickness, lying on a stratum of fine sand and gravel, and above it are ten feet of rich alluvial earth. It is composed of oak, birch,

and hazel branches lying horizontally. In many other places on the banks of the Spey, the Lossie, and tributary streams, deposits of vegetable remains are found, which, although not of great extent, all exhibit the same characteristics.

At a period not very remote, peat had been extensively distributed over the upper and lower parts of Moray; but the spirit of improvement in agriculture has in many places diminished its extent, and converted it into productive soil. It would be impossible to point out the numerous localities in which peat is found, as it appears in isolated patches over the whole county, in the bottom of the lowest valleys, and on the summits of the highest hills. Large trunks of oak and fir are imbedded in it, many of them upwards of twenty feet in length, and twelve feet in circumference, the roots being found under it. The trees are always found in a preserved state, and the fir trunks have long been used by the people for joists and rafters to their buildings; and many of the oak trunks have been cut up and made into furniture by gentlemen in the county. The fir roots are used, when cut into thin splinters, for candles by the country people, and formerly they were so plentiful, that many cart-loads of them were carried to the towns and sold for that purpose.

3. *Sand-drift*.—In Moray, the effects of drifted sand, have been ruinous. At a former period, it would appear some terrible hurricanes and convulsions had taken place, not only on the coast of Moray, but all along the eastern shores of Britain. To these eruptions may be traced the origin of the vast accumulations of sand, which had, at a later period, extended over some of the finest and most fertile districts of Scotland situated on the sea-coast. At the period referred to, it is not probable that sand in any uncommon quantity had been thrown up on the shores of Moray; on the contrary, it would appear that, from the mouth of the Spey to the county of Nairn, a succession of shingle beaches had been accumu-

lated, but on the coast of Nairn, both shingle and an immense quantity of sand had been thrown up. It is from this accumulation of sand, called the Maivestown Hills, in the county of Nairn, that the great sand-flood of Moray proceeded, desolating in its progress some of the most fertile districts. It commenced its ravages on the northernmost part of the parish of Dyke, and entirely destroyed the beautiful estate of Culbin, in that parish.

This extensive sand-flood had not confined its desolating ravages to the parish of Dyke, but extended over the northern parts of the parishes of Kinloss, Alves, Duffus, and Drainie. In many parts of Duffus the sand has been trenched down, and the original soil, which is of a clayey nature, with all the marks of former cultivation, thrown on the top.

The sand-hills are now happily little affected by the wind, in a way to lead to any disastrous consequences; because those hills at a distance from Culbin are nearly covered with *Arundo arenaria*, and other signs of vegetation are creeping up their sides. It is fortunate for the inland parts of the county that the north wind makes but little impression on the sand. It cannot be said, however, that the sand is stationary, for, when the south-west wind blows, it is still seen drifting furiously on Culbin; and hills which are fully fifty feet high, will in one night be completely altered in figure.

4. *Changes by the sea.*—The sea is making extensive inroads upon the coast; and although its progress may not be detected at any particular time by a casual observer, yet its work of destruction is going on silently and incessantly. The historical records of the county state, that, prior to the year 1701, the town of Findhorn stood on a plain a mile north-west of its present situation: this plain, and the site of the old town, being now covered with the sea. This disastrous circumstance happened in one night. It is likewise recorded, that, about the same period, the distance between Burghhead

and Findhorn in a direct line, over a level tract of moor, was about five miles; this distance is now extended to upwards of ten miles, the shore being now in the form of a semicircle. It is here that the submarine forest formerly alluded to is found, extending for a considerable distance under the sea. The materials on which the waters have to exert themselves here is an ancient shingle beach, composed of water-worn stones and sand; these are easily undermined, and portions are incessantly falling, which are carried away by the tide, and deposited on some other part of the shore.

Although little attention has been directed to these encroachments, it would appear that, in little more than a century, no less than 4000 acres have been swept away; this extent of ground was, however, comparatively of little value, being composed of shingle, covered with unproductive sand-hills.

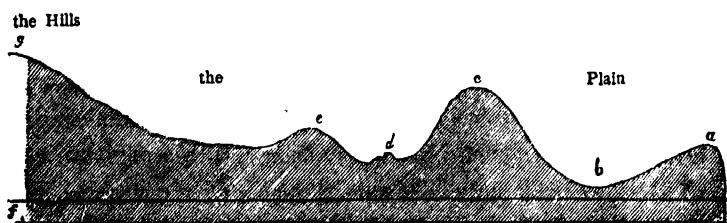
From the mouth of the Spey westward to Nairn, very extensive ridges of water-worn stones have been thrown up along the coast; the more interesting portions of which are to be seen between Lossiemouth and the Spey. They consist of rolled pebbles of granite, porphyry, gneiss, limestone, sandstone, and breccia; in all likelihood, the debris of formations lying to the west. The ridges run parallel to the shore, and rise in succession to a great height, like the waves of a tempestuous ocean. Some of them rise to the height of forty feet above the level of the sea, but they all decrease in height as they near the shore. The intervals between these ridges extend from sixty to a hundred yards in breadth, and are composed of the same materials. The more inland ridges are composed of larger stones than those nearer the shore, some of them measuring about a foot in diameter; and it is observed that, among the accumulation of large stones, there is not a particle of sand to be found. In some of the lesser ridges, composed of pebbles varying from one inch to two

inches in diameter, there are beds of oyster-shells, a foot in thickness.

II. DILUVIUM.—The deposits which belong to this section mark a more distant era than those in the last, and are the effects of causes no longer operating in this district. Over the whole plain, and in many places immediately under the alluvial deposits, immense beds of great depth of water-worn gravel, sand, clay and boulders are found. This diluvial debris prevents the correct examination of the stratified rocks below. The debris unquestionably owes its origin to the disintegration of the more ancient formations, and its position over the stratified rocks on the plains and hills is clearly owing to an extensive deluge which had swept along after the completion of the newer stratified rocks.

In the hilly part of the country the diluvium is still entire, with the exception of a few sections, the effects of mountain torrents, where it measures no less than 100 feet in thickness above the primitive rocks. This is, no doubt, the maximum of thickness, for it thins off, as it approaches the valleys, to two or three feet. The debris consists of a mass of gravel with a thin stratum of sand here and there, with large boulders of granite and porphyry. No remains of extinct mammalia have been discovered in it, to lead to its identification with other deposits in which organic remains have been found.

That an oceanic current of immense power had traversed the lower part of Moray from west to east, is evident from the remains of the more solid parts of the strata, formed into parallel ridges running from west to east, the more friable parts having been carried away by the action of the water. Those ridges will be shewn to more advantage in this section than by any verbal description.



In the figure, *a* is a ridge of sandstone skirting the shore of the Moray Frith. It rises to the height of 100 feet above the level of the sea. It is surmounted with a vast diluvium, intermixed with boulders and immense blocks of porphyritic granite, some of which cannot be less than ten tons. *b* marks the situation of the ancient basin of the Lake of Spynie, and previously an arm of the sea. In some places it is scarcely six feet above the level of the sea. The breadth of plain between *a* and *c* is about two miles. *c* is another ridge of sandstone upwards of 300 feet high, but decreases in height as it extends to the eastward till it merges into the level of the plain. *d* is a part of the plain apparently scooped out by the force of running water; it shews various inequalities, by lesser ridges running parallel with the main ridge *c*. The town of Elgin stands on one of the inferior ridges. *e* is a bed of limestone resting on a bed of sandstone; this ridge sinks into the level of the plain at Waulkmill. Between *e* and the hills *g*, another level tract occurs, obviously effected by the same agency which formed the levels *b* and *d*. All these ridges expose a bold front to the west, but sink lower and lower as they recede to the eastward, till they lose themselves in the general level. Over the whole plain of Moray boulders of granite, porphyry, gneiss, and basalt are found, part of them having all the appearance of being brought from the Great Glen in Inverness-shire; and the beautiful red porphyritic granite of Nairnshire is extensively scattered as far as Portsoy in Banffshire. *f* indicates the sea level.

Perhaps it may not be here out of place to mention the characters of the more remarkable boulders found over the plain. In digging a new channel for a burn at Lhanbryd, a mass of stone, of some tons weight, was discovered. It was of sandy, calcareous nature, and bluish-grey colour, with a great variety of marine shells imbedded in it, many of them quite distinct and well defined. Small portions of fossil plants, completely carbonized, were likewise found. The only rock exhibiting similar characters is found at Brora, about 100 miles distant, overlying the coal measures. Large boulders of greenstone, of large granular texture, composed of felspar and hornblende, with sulphuret of iron disseminated, are scattered over the upper and lower terraces, and over the Glen of Rothes. Similar rocks are not found in situations nearer than thirty miles. Boulders of claystone, of a reddish-grey colour, having a basis of uncrystallized felspar, with quartz and mica imbedded; in some parts the mica is found an inch square. The felspar of this stone is so much decomposed, that it can easily be fretted away by the fingers.

A striking display of the course of one branch of the current, that swept over the plain of Moray, is seen in a sand deposit in the upper part of the plain, extending from Birnie to Garmouth, a distance of twelve miles, and about three quarters of a mile in breadth. It is conjectured by many of the people of the district that the sand had been drifted across the country by wind, but this hypothesis is quite insufficient to account for the large boulders which are occasionally met with in the sand. This extended tract of sand was, until lately, considered unworthy of cultivation. It was covered with *Genista scoparia*, and in some places with *Calluna vulgaris* and *Ulex europæus*; these have now completely disappeared, and given place to luxuriant corn-fields.

There is a very singular thin bed of agglutinated sand and gravel found in connection with the diluvium of the lower part of Moray. It is generally at the depth of from one to

three feet from the surface, and appears to be, when not broken up, most unpropitious to the superior soil. The sand and gravel are connected together by an oxide of iron.

The boundaries of the immense volume of water which had formerly covered, and subsequently passed over the county, are distinctly defined by the extensive terrace banks along the coast. They may be traced from Banffshire, through Moray and Nairn shires; and on the opposite shores of the Frith, corresponding terraces can be traced from Inverness to the Ord of Caithness. These terraces clearly define the extremes of an extensive basin, whose waters had, at a remote period, covered the lower parts of Moray, Nairn, Inverness, and Ross shires. In Moray the ancient shores are now separated from the sea by extensive tracts of land, in some places above eight miles in breadth; but on the opposite coast the sea approaches, in some places, to the very base of the terrace banks.

III. LIMESTONE.—Above the sandstone, an extensive deposit of limestone is found. Its structure is sub-crystalline, compact, and of bluish-grey colour. It inclines with the sandstone to the north. The minerals found in it are grey-coloured, transparent calcareous spar, shewing in some instances a degree of iridescence; galena of a lead-grey colour, easily frangible and of hexahedral form; and beautiful crystals of quartz are found in the crevices of the rock, particularly in the limestone, which extends along the shores of the Frith, and which is much more crystalline in its texture than the limestone stretching over the interior of the county. A range of this limestone can be traced from the Boar's Head, a rock covered at high water on the shores of the Moray Frith, opposite to Innes House, through the lands of Innes, Meft, and St Andrews, to the Lossie at Waulkmill, over an extent of six miles, where it keeps at a low level, and exposes but partial outcrops. After crossing the Lossie, it

rises by degrees in the form of a ridge, which increases both in height and breadth as it extends to the west. To the south of Elgin, on the Trades' Moor, it attains its greatest height. Here are three limestone quarries, within a short distance of one another, which present the only sections on the range. The limestone is twenty feet in thickness; above it is a bed of red clay of six feet, over which is a bed of sand and gravel, varying from one to four feet, the diluvium being intermixed with boulders of granite, porphyry, quartz, and greenstone. The ridge of limestone continues westward to the Lossie, but diminishes in height as it advances, where it again falls into the level of the plain, and, extending a short distance farther, is ultimately lost sight of at Pittendrich. Great quantities of this limestone, when burned, is used for manure; it is of excellent quality, and has been of great benefit to the farmers in the hills, both in enriching soils which have been under cultivation, and ameliorating the inert properties of new land. Limestone of an impure quality is extensively quarried in some of the quarries of this ridge as a building-stone. Under the limestone is a greenish grey-coloured sandstone, in all probability the crest of a ridge of the great sandstone deposit of Moray, which has changed its yellow colour by its contact with the limestone.

Another branch of this limestone extends from the Boar's Head to Sheriffmill, a distance of eight miles. It is seen skirting the lake of Spynie opposite to Pitgavenie, and shews itself to a great extent and thickness in the limestone quarry at Linkfield. Here it is found an outlying portion, alternating with shales and clays, but in the quarry it is of great thickness, having beds of red and blue clay overlying it.

To the north of the last mentioned branch, and bordering on the shores of the Moray Frith, another branch of limestone is seen extending from Lossiemouth to Inverugie, a distance of seven miles. This branch appears not to be continuous, or, if it is, it presents no intermediate outcrops, and I am in-

clined to believe that the intermediate parts have been removed. The limestone here appears much more crystalline in its texture than that which occupies the inland ridges. Its drusy cavities are entirely covered with crystals of quartz, and galena is extensively disseminated throughout the mass. It dips 10 degrees to the north.

At Cothall, on the banks of the Findhorn, a distance of fourteen miles from the termination of either of the above mentioned ridges, another mass of limestone occurs. It has the same inclination and dip as the limestone in the neighbourhood of Elgin, and bears a close resemblance to it in all its characters. It is probable that this limestone is a continuation of the ridge found at Elgin, and although its continuity may be hidden by the diluvium which covers the intermediate space, or may have been interrupted by the destructive action of water, it is extremely probable that both constitute portions of the same deposit. It is probable that the limestone covers sandstone over a great portion of the plain. It is found under the town of Elgin, and likewise under the lake of Spynie, where it alternates with the sandstone.

IV. SANDSTONE.—Under the deposits and rocks previously described, and limited to what is not inappropriately designated “The Laigh o’ Moray,” is an immense sandstone deposit; and, notwithstanding the great accumulation of diluvium which in many places conceals its outcrop, there are many interesting sections of it obtained along the shore, on the line of the rivers, and in the inland ridges. The sandstone in all probability occupies the whole of the low country, and although it shews itself only along the line of ridges which intersect the county, yet it would appear from a late undertaking in quest of coal, that it pervades the lowest levels.* The coast from Lossiemouth to Burghhead, a dis-

* The late John Brander, Esq. of Pitgavenie, on the supposition that a continuation of the coal of Brora might be found on his estate, bored to

tance of nine miles, presents one continuous ridge of this stone, exposing vertical sections upwards of a hundred feet in height. This ridge is capped by an immense bed of diluvium, composed of layers of gravel and sand, alternating with thin seams of clay. Ten feet of the diluvium, immediately above the sandstone, is composed of red sandy clay, interspersed with the debris of the sandstone, appearing as if torn up with violence, and huddled together without any regularity.

Another ridge runs south of the above, parallel with it, and separated from it by the ancient basin of the lake of Spynie. It is named the Hill of Quarrywood. At the west end it rises to the height of 300 feet above the level of the sea. Its continuity is unbroken from Alves to Pitgavenie, a distance of ten miles. There is nothing which particularly characterizes the sandstone of this ridge, unless it be the circumstance of its passing from the westward through the gradations of a conglomerate, a granular, and a minutely granular texture. The depth of the sandstone has not been ascertained. It has been found at the lowest levels, and under the lake of Spynie it is 100 feet in depth. On the sides of this ridge deposits of red clay, twenty feet in thickness, are met with. This clay decreases gradually as it ascends the ridge, and at its height almost disappears, and gives place to a mass of diluvial debris, similar in its character to that which is in immediate contact with the ridge on the shore at Covesea. Along the sides and summit of the hill of Quarrywood, there are hollows running parallel with the ridge, having apparently been scooped out by running water. On the hill of Spynie, the diluvial debris, above the sandstone, is intermixed with fragments of a cherty limestone, the original of which being found to the west.

On the Findhorn, the sandstone rises on both sides, to the height of seventy feet above the bed of the river, and extends

the depth of ninety-seven feet, through a bed of uniform sandstone, with the exception of a few thin seams of limestone, found at two or three different depths.

from Sluie, where the primitive formation commences, to a little below Cothall, a distance of two miles. In this locality the rocks dip in general to the north, at an angle of 10° . At Sluie, near the termination of the secondary rocks, the sandstone turns into a coarse conglomerate, or breccia, some of the fragments being round, and some not, and feebly agglutinated. Its basis is sandstone, with pebbles of porphyry and gneiss imbedded, more or less rounded, apparently the debris of the primary rocks in the neighbourhood. A similar edging to the secondary rocks is seen to the south of Elgin, under the lower escarpment of the terrace bank, with this difference, that the basis appears of calcareous nature, and the pebbles larger and much more abraded. This part of the deposit exhibits a striking similarity, in texture, to the shingle beach along the shore at the present day, and leads us back to that remote period when the conglomerate may have formed the beach, and the sandstone, in the form of sand, the bottom of the ocean. The dip of the strata in the interior of the plain is to the north, that on the shore is to the west; and if the strata of the secondary rocks on the opposite shores dip to the south, and those on the west to the east, we should have a series of dips, all converging to a certain point in the Frith, marking the hollow of the basin on which the secondary rocks have been deposited.

We have occasion again to revert to the ridge of sandstone which skirts the shore. On descending from the little village of Coveasa to the shore, is a line of lofty mural precipices, in some places upwards of a hundred feet in height. The scene here is strikingly grand. On the fore-ground rises a lofty pyramid of sandstone, seventy feet in height and about thirty across its top; it tapers downwards towards its base, where it measures only eight feet in thickness. It is astonishing how this prodigious overhanging mass can be supported on seemingly so slender a base. Many a time have I seen a few little boys, as if taking advantage of its apparent weakness,

put their shoulders to its leaning side, and aim to overturn it. There is a stability, however, in this plaything of nature, which will perhaps remain an example of her vagaries, when the gorgeous palace and the turreted castle will have crumbled into dust.

To the westward a series of caverns may be seen, one of which possesses the peculiar interest of having been used as a stable by Sir Robert Gordon of Gordonton, in the rebellion of 1745.

The sandstone extends a far way into the Frith, in the form of reefs or skerries, which are very dangerous to navigation: scarcely a season passes without some vessels sustaining damage on them. The Commissioners of Northern Lighthouses would confer an inestimable benefit on the venturous mariner, were they to direct their attention to this danger, and cause a lighthouse to be erected on the point called "The Muckle Skerry." The skerries are covered with various kinds of sea-weed, such as *Fucus digitatus*, *F. mamillosus*, *F. palmatus*, *F. subfuscus*, *Ulva compressa*, and *Conferva rupestris*.

In walking along the shore, many vertical contortions are observed in the sandstone. In several places these contortions interrupt the regular line of strata, and cause a subsidence at their ends, as if the sand at the time of its deposition had been whirled downwards by an eddy in the stream. That these contortions had taken place previous to the consolidation of the rock, is evident from there being no mark of recent displacement in any part of the strata. The rocks in these particular parts do not appear so compact, as those in their immediate neighbourhood. This sandstone is of a grey yellow colour, composed of minute particles of quartz, more or less rounded. The stone which occupies the western end of the principal ridges, is much more granular in its texture than the stone which occupies the eastern parts; it is likewise characterized by small grains of calcareous matter dissemi-

nated throughout it. No organic remains have hitherto been found in it.

In connection with this formation, it may be proper to mention, that small portions of shales and clays, the remains of lias strata, are to be found to the north of Elgin overlying the yellow sandstone. This formation has most likely been torn up by the force of a powerful current, and removed from its original position.

The red sandstone formation, which displays outlying portions both on the Spey opposite to Fochabers, and at the north end of the Glen of Rothes, has, to all appearance, experienced a similar disruption. This formation shews itself in a narrow ridge, about a mile in length, along the western bank of the Spey. It is composed of red sandstone, associated with beds of sandy marl, alternating with and resting on a fine conglomerate. The direction of the ridge is from north to south; nearly, the inclination of the strata is to the west, dip 10° . The deposit at the Glen of Rothes is a variegated sandstone, red and white, pervaded by thin laminæ and nodules of red marl. It rests upon a very coarse conglomerate, which in some places seems to be connected with a cement of calcareous nature. The strata dip to the north. The finer parts of the conglomerate are used for building-stone, and the marl is applied as manure to the land.

V. GNEISS.—Over the whole of the upper part of Moray, wherever a section is obtained, whether on the banks of a river or stream, or on the edge of a deep ravine, gneiss is the rock which presents itself. The greatest display of this rock is seen on the Findhorn, commencing at Sluie, where the secondary rocks terminate, and continuing up the river to the boundaries of the county. In many parts of the river the rock rises to the height of seventy feet, traversed by veins of beautiful red porphyry. In others it has lost its adhesive property, and disengaged large masses into the bed of the

river. Thin laminae are likewise easily separated by the hand. The fragments, after falling, soon moulder down and are carried away by the stream. The porphyry, however, is not so easily decomposed, for its fragments retain their consistency, and form rolled masses in the bed of the river. Masses of beautiful red porphyritic granite are embedded, and veins of it ramify almost through every part of the gneiss in all directions. The strata incline to the south-west. Eastward of the river there is great difficulty in finding a section, owing to the immense covering of diluvium extending over all the upper district. There are some places, however, where the edges of the beds make their appearance to a limited extent, and it is by these points, like stepping-stones, that we are enabled to trace the rock, and connect the portions into a whole.

On many of the streams between the Findhorn and the Spey small beds of gneiss present themselves, but they appear noways interesting, except for serving as lines of connection between the sections on the two rivers. These beds also display their edges at Kellas, Dallas, and Rothes, and on some small streams associated with porphyritic granite. At Rothes large masses of porphyry stand out, from the gneiss scaling off around them, and veins above a foot in thickness form ledges in the bed of the river, the gneiss being washed away. Beautiful veins of red felspar, with large pieces of mica imbedded, running parallel with a blue glistening quartz, traverse the gneiss in a direction contrary to the plane of the strata. At Craigellachie a very extensive section is exposed on the banks of the Spey, by the cuttings which have been made to form an approach to the iron bridge. It is upwards of seventy feet high, and inclines to the west 30 degrees. It shews a series of parallel rents, rising nearly perpendicular above the plane of the strata; whilst veins of porphyry traverse the rock in nearly a horizontal direction.

Small patches of mica-slate, associated with the gneiss, are found at Rothes, on the Moor of Logie, and several other places.

The mica-slate of Logie was at one time quarried to a certain extent for roofing-slate for farm offices. On entering the upper part of the county, a very coarse conglomerate, having a coarse gritty basis, is found in large masses without much appearance of stratification. It most probably overlies the gneiss.

The summits of some of the hills near Rothes are capped with a beautiful white quartz, variegated with red and blue streaks. In its druses are found some very resplendent crystals. Some time ago a lapidary was employed by a gentleman in the county to form vases from this rock, and beautiful specimens, as well as highly finished snuff-boxes, were cut from it.

RELATION BETWEEN ROCKS AND SOIL.—It must be a task of great difficulty to point out the relation that exists between the nature and fertility of the soil and the rock formations in this district, especially when the attempt is made on perhaps not an inch of native soil for miles around; in fact, we can scarcely point to any particular place where the disintegrated portion of the rock overlies the rock itself. The detritus of the rocks having been transported to a distance, and the deposits now covering them being a foreign substance to the rock, it is impossible to establish a connection between them. When an accumulation of diluvium, varying from three to a hundred feet in thickness, intervenes between the subjacent rock and the soil, there must be a very distant relation between them, and the fertility of the one can be little affected by its proximity to the other.* Great progress is making in

* In these remarks our author, we conceive, has misunderstood the object of the requisition of the Society for geological writers to ascertain correctly the relation between soils and subjacent strata. The object of the Society in requiring correct descriptions of soils and subsoils, is to ascertain, if possible, the cause of the natural fertility of soils. To attain this object, it is immaterial whether the subsoil immediately under the arable soil is indurated rock or alluvial deposit, and whether the latter is the undoubted debris of the former. There are perhaps in reality very

this district in the improvement of waste land, and many farms in the parishes of Birnie, Rothies, Knockando, Dallas, and Edinkillie, shew refinement of cultivation.

REMARKS.—Although this district is destitute of animal remains and valuable minerals, yet there are minerals in it which possess great economic utility. The beautiful yellow sandstone, which is so abundant in the plain, is highly esteemed for building, and perhaps for beauty and durability cannot be surpassed by any other stone in the kingdom. It is quarried extensively at Covesea and Quarrywood.

The limestone obtained from the quarries at Glassgreen, Linkwood, Inverugie, and Cothall, is of great importance, both for building and agriculture. All new improvements in land are manured with lime, and it is pleasing to observe the extent of hill-ground brought into cultivation since it was used as manure.

No traces of coal have been discovered in the district, but trials have been made at no little expense in quest of it. It is evident, however, that the strata do not belong to the coal formation.

Thin beds of marl have been met with in the Loch of Spynie, and in the parishes of St Andrew's and Urquhart, but they were so small as to be soon exhausted.

few soils which are in cultivation that have originated from the disintegration of the rock immediately under them. But it is very material to ascertain the exact mineralogical characters of the arable soil, and of the subsoil immediately under it, be that subsoil an indurated rock or alluvial deposit. A correct mineralogical description of the subsoil will enable the Society to judge whether the arable soil of the district geologically described rests on a porous, retentive, deep, or shallow subsoil, and whether it contains similar earthy materials to the arable soil. By these characteristics correctly described, the probable fertility or infertility of the soils, and the favourable or unfavourable nature of the subsoil may be deduced; and should the deduction accord with the agricultural experience of them, means of judging of the natural fertility or infertility of soil, and of ascertaining its cause or causes, may thus be established on a scientific basis.—ED.

ACCOUNT OF THE METHOD OF CALCINING LIMESTONE IN
SOME OF THE LIMESTONE QUARRIES IN SCOTLAND. *By*
Mr JOHN WALLACE, Mansfield House, Cumnock, Ayr-
shire.

[Many particulars of the principal lime-quarries in Scotland, furnished by Mr Carmichael, having been already published in this volume of the Society's Transactions, at page 58, those remarks of Mr Wallace are only given in the following paper, which refer to particulars not noticed by Mr Carmichael, such as the construction of kilns, and general observations on the usual method of calcining limestone. The Society's Silver Medal was adjudged to Mr Wallace.]

CLOSEBURN Lime-works in Dumfriesshire, belonging to C. G. Stuart Menteath, Esq. of Closeburn.—The following letter regarding the construction of the limekilns, and the method of calcining the limestone at Closeburn, by the proprietor Mr. Stuart Menteath, will embrace all that can be said upon that subject, and in more concise and satisfactory terms than I could describe it.

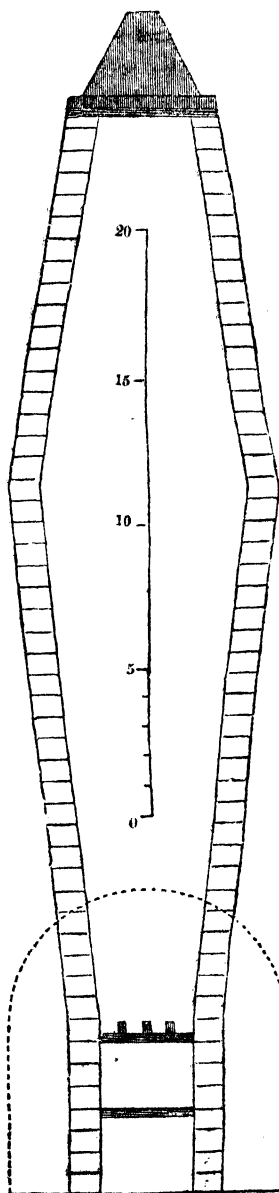
“ Having been engaged in burning lime for the supply of an extensive district of country for agricultural improvements, and being distant from coal sixteen miles, it was desirable to find out the best constructed kiln for burning lime with the smallest quantity of coal; and having been aware, from experiment, that the kilns generally employed in Great Britain for burning lime, of the construction narrow at bottom, and wide at top (many kilns of this construction being not more than three or four feet wide at bottom, and eighteen feet wide at the height of twenty-one feet), were found to waste the fuel during the process of calcining the lime, or, in other words, did not produce more than two measures of burnt limeshells for one measure of coals; but it is to be understood that, in whatever construction of kiln lime is burnt, the fuel

required to burn limestone must vary according to the softness, or hardness, or density of the stone, and the quality or strength of the coal used. The same measure of coal, in Scotland called *chews*, when employed, will burn a greater quantity of lime in a given time than the same quantity or weight of small coal, the chews or small pieces of coal admitting the air to circulate more freely through the kiln. Though this fact should be well known to lime-burners, yet they frequently employ small coal in burning lime, from its being procured at a less price, though really at a greater expense, as it requires a much *larger quantity* to produce the *same effect*, and a *longer time* to admit of *equal quantities* of lime being drawn out of the same kiln *in a given time*.

“ For a sale of lime for agricultural purposes in a limited district, I have found kilns of small dimensions to be most profitable: the construction of a kiln I have employed for many years being of an oval shape, widening gradually, and contracting again towards the top, as shewn in the figure. The accompanying scale in the figure will best describe the dimensions of the kiln. A kiln of this construction has been found to burn lime in much less time, and with a smaller proportion of fuel, than kilns of large dimensions, narrow at bottom and wide at top, as heat is well known to ascend more rapidly in a perpendicular than in a sloping direction, from which arises the superiority of a narrow kiln, with sides nearly perpendicular, compared with one with sides that slope rapidly.

“ These narrow kilns will admit of being drawn out of them every day, if fully employed, more than two-thirds, or nearly three-fourths of what they contain of well burnt lime, and afford fully three of lime-shells for one measure of coal, when large circular kilns will not give out more than one half of their contents every day, and require nearly one of coal for every two measures of lime burnt. In a country sale of lime, the quantity sold every day is liable to great fluctuations,—only two or three cart-loads will sometimes be required

for an establishment which the day before required forty ; and as lime is known to be a commodity, when exposed to the action of the air, which becomes more powdery by slacking, and heavy by absorption of carbonic acid, and in that state does not admit of being carried to a distance without additional labour, it has been an object of importance with me to find out a construction of a kiln which will allow of lime being kept for several days without slacking, and at the same time to prevent the fire escaping at the top of the kiln, if the kiln stand twenty-four hours without being employed, especially during the autumn and winter, when the air is cold and the nights long. I now employ kilns of an egg-shape, and also oval, the oval-shaped kilns being divided, by arches across the kiln, descending four feet from the top, the object of the arches across the kilns being to prevent the sides of the kiln falling in or contracting, and also enabling you to form circular openings for feeding in the stone and coal at the mouth of the kiln. Upon this plan a kiln of any length might be



444 *Mr Wallace on the methods of Calcining Limestone.*

constructed, with numerous round mouths. In the model of the kiln sent to the Highland Society, Booker's conical cover may be seen revolving upon an iron ring placed upon the circular mouth, and having placed a lid to the cover, I am enabled to prevent the escape of heat at the top, and by cast-iron doors at the bottom, the air is prevented passing through the kiln, so that by these precautions the lime-burner can regulate the heat, and prevent its escape for several days, when the fire would be extinguished at this season in the course of twenty-four hours. This is an object of great importance, as it enables you to burn lime as well, and with as small a quantity of fuel in the winter as in the summer season, and to supply the farmer with as good burned lime, and at any time of the year, which cannot be done in the common construction of kilns open both at top and bottom, for the reasons I have before stated. From the great expense attending the driving of fuel from a distance of twenty-five miles from my own coal-pits, I have adopted the practice of coking the coal, which is a saving of eight-twentieths of the weight, and I find that an equal measure of coal and coke have the same quantity of heat in burning lime, which is somewhat paradoxical, but not the less true. The coal is found to have little effect upon the stone till it is deprived of its bitumen, or is coked in the kiln, for during the time the smoke is emitted from the top of a lime-kiln, little or no heat is evolved, or, in other words, the smoke carries off the heat, which is not given out from the smoke till it is inflamed, which does not take place in the ordinary lime-kilns. When the coke is employed for burning lime during the day, small coal should be used in the evening, in order to prevent as much as possible the escape or waste of heat during the night, from the rapid circulation of air through the limestone in the kiln, where coke is the fuel made use of for its calcination. A kiln in which coke is the fuel employed will yield near a third more of lime-shells in a given time than when coal is the fuel, so that coke may be used occasionally when a greater

quantity of lime is required in a certain time than usual, as it is well known to limeburners, that the progress of burning is done most economically when the kiln is in full action, so as almost constantly to have a column of fire from the bottom to the top of the kiln, with as short intervals as possible in working the kiln.

“ Having found that limestone is apt to be vitrified during the process of calcination in stormy weather, from the increased circulation of air through the kiln, which adds much to the heat derived from the fuel employed, and which experienced limeburners would have diminished, could they be aware at all times of an occurrence of this kind ; from having experience of the bad effects of too great a circulation without properly providing against it, I have reason to believe, that, having a power to throw in at pleasure an additional quantity of air into the bottom of a lime-kiln, that a considerable saving of fuel necessary for the calcination of lime would take place, and another object would be gained, that of cooling the limestone in the bottom of the kiln, which frequently retards the drawing out of the burnt limestone for some hours, or until the limestone is so cold as not to burn the wooden structure of carts.

“ In working a kiln with narrow circular mouths, the stone and coal should be carefully measured, so that the workmen may proportion the quantity of fuel employed to the quantity of stones ; and it is obvious that the quantity of coal to be used must depend upon its relative quality, and the hardness of the stone to be burnt. If this measure was adopted in kilns of any construction, the lime-shells would be found better burnt.”

Kilnhead Limeworks near Annan, belonging to the Marquis of Queensberry.—The lime-rock at Kilnhead is quarried open-cast. At present the rock lies under a cover of diluvial matter, consisting of clay and stone intermixed, about 24 feet deep, which is removed at an expense of 6d. per cubic yard. The limestone, about 30 feet thick, lies in beds about fifteen

in number, is exceedingly compact and hard, dipping north-east about 1 to 10 and 12 degrees. The limestone is red, reddish-blue, and reddish-green, in the different beds, and contains great quantities of marine-shells and other organic remains. Marble slabs have sometimes been got out of this quarry, but were found too full of dries to be profitably used for chimney-pieces. The rock is quarried by blasting with gunpowder; the boring is performed by way of *churning*; a long jumper, with a ball in the centre, is placed in a cast-iron frame or block, about a foot in length, with upright tubes in which the jumper is placed, and the man, by merely lifting it up, the weight of the jumper bores the stone without the use of the hammer, by which a considerable saving of iron is effected, the heads of jumpers being more worn by the hammer than on the point by the rock. The pick and common iron-lever is also used, and large hammers to break the pieces into convenient sizes for filling into the waggons.

A steam-engine and water-wheel is here erected to draw the water out of the quarry, the engine being only used in dry seasons. A chain-pump is applied to the water-wheel, and a draw-pump to the engine. The engine, if of sufficient power, might be profitably applied in drawing up the limestone from the quarry to the kiln head, a height of 40 or 50 feet. The expense of quarrying is about 25s. per 100 Carlisle bushels, of three Winchester bushels, about 50,000 of which are sold annually. The lime is of the purest quality, producing 85 to 90 per cent. of pure carbonate of lime. The expense of baring is about 3s. upon the 100 Carlisle bushels, and burning 6s. 6d. The rock, when quarried, is carried to the kiln head, up an inclined plane, by horses. From the hardness of the stone, one measure of coal will only burn from two to two and a half measures of lime. The kilns are of much the same construction as those at Closeburn, being oval, 25 feet deep, 5 wide, and from 7 to 10 feet long, with grates and iron-doors on the eyes at the

bottom. All the operations connected with this work are managed in the best style.

At *Baldoran*, on Glorate estate, the lime-rock called the *Calm Lime* is wrought. The post, about 3 feet thick, lying about 9 feet above a 4 feet coal, is mined by pooling in the bottom in blase, and afterwards blasting down. The stone is wheeled in a barrow to the clay, and burned in clamp or sow kilns. The coal is also wrought here, and sold and used for burning the lime. In the clamp-kilns here, owing to the caking quality of the coal, great pains are taken when setting or filling the kiln, to carry three small pipes or pens through the bottom, and up the sides and ends of the kiln, in order to give them air. This should be attended to in all clamp kilns, which will greatly hasten the burning. The people employed are paid 7s. per chalders of shells, of 32 bushels, for mining, burning, and working the coal, &c. and the lime is here sold at 12s. per chalders.

At *Burbieston*, about two miles south, the same lime-rock is wrought and burnt in clamp kilns, built merely with earth, and lined with clay, which, after the first firing, is equal to brick. The lime-rock here is only $2\frac{1}{2}$ feet above the coal, which is 4 feet. The coal is wrought first, and the lime afterwards. The stratum betwixt the coal and lime is alum-shale, containing pyrites, which used to be taken out for the manufacture of alum and copperas in the neighbourhood. In these kilns it was stated, that 17 cwt. of coal will burn a chalders of 32 bushels of lime-shells, which is sold at 14s.

In *Old Kilpatrick*, at *Duntocher*, the property of Mr Dunn, the same limestone is wrought; the pit is 30 fathoms deep; the limestone is 4 feet 9 inches and the coal 4 feet 9 inches, with little separation; the coal is wrought first, stoop and room, and is of a caking quality; the limestone is afterwards blasted down. The miners are paid 6s. per heap of 5 tons. A steam-engine is employed to draw the water, coal, and limestone out of the pit.

The lime is burned here in the old clamp or sow kilns,

care being taken to put in three air-pens built of limestone, and carried up the sides and end, and stocking with brush-wood. It was stated, that one ton of coal was required to burn a chalders of lime of 32 bushels, equal to about two of lime for one of coal, which is sold at 15s. per chalders of shells. The men employed in filling the kilns are paid by the day; but the burning alone was stated to cost 1s. 4d. per chalders. It was farther stated by the manager, that there would be a great saving of both coal and labour, by having draw-kilns instead of those in use, for, beside the extra expense of burning (nearly one-half), the sow-kilns require a great deal of cleaning out every time they are filled.

Netherston Lime-works.—The rock is about 10 feet in depth, wrought both open-cast and mined. The mining operation is carried on by pooling in the bottom, and the rock afterwards blasted down. The rooms are about 20 feet wide, which appeared to be too much for the roof. This operation costs 7s. 6d. per square yard of pavement. The limestone is carried on a railway by a man to the kilns which are at hand. The kilns are thirty feet deep, contracted from two feet by three long at bottom, to ten feet diameter half way up and the remainder perpendicular, with iron rings on the top to protect the masonry round the mouth. The coal used is small and inferior, and will take 18 carts to burn 100 bolls of lime-shells; 2 bolls or 12 bushels to the cart sold at 4s. per cart. Sale 7000 bolls yearly. The eyes of the kiln have two cast-iron frames, each one and a half foot square, and an air-hole is carried up the back of the kiln five feet, no doors or grates are used. This kiln is stated to burn about the proportion of $2\frac{3}{4}$ of lime by one of coal in measure.

Charlestown Limeworks, county of Fife, belonging to the Earl of Elgin.—The lime-kilns are erected at the harbour of Charlestown, all substantially built and lined with bricks. The arches are carried all round the kilns, having four eyes, about twenty-four feet deep, fifteen diameter at the top, tapering to three or four at bottom, with cast-iron rings at the top, to pre-

serve the brick-work, and a saddle at the bottom, to conduct the lime equally into each eye. The coal used here is the refuse of Lord Elgin's coalworks near Dunfermline. The stone would appear to be easily burnt, from the large size of the stones when thrown into the kiln, but which is the cause of producing great quantities of unburnt stone. This unburnt limestone is as far as possible slacked and riddled, and the flour sold separately from the lime-shells, and the refuse thrown into the harbour, for the purpose of forming a break-water or pier.

If grates, with bars twelve to eighteen inches asunder, according to the size of the stones, were employed at the bottom of the kilns, a much less quantity of unburnt lime would be drawn out, and a great saving in the labour of baring the rock, quarrying, carriage to the kilns, and breaking the limestone, and also in coal, would be the consequence. Grates of this construction, so successfully employed by Mr Stuart Menteath of Closeburn, at Mansfield, in Ayrshire, were tried at Charlestown, but, owing to the workmen employing the same quantity of coal they were accustomed to do in burning lime in the other kilns, the stone was drawn down through the grates vitrified. Not being aware of this result having arisen from the use of too much coal, the grates were condemned, although they proved beneficial, in admitting the air freely from the bottom to the top of the kiln, the lime being burnt in less time, and a smaller quantity of coal necessary for the calcination of a given quantity of lime-shells. In using grates of this construction, great care should be used in first lighting the kilns, by placing thin flags on the upper bars, in order to keep the burning fuel above them, but which, if allowed to fall down, the heat both above and below would soften, bend down, and destroy them. At no time should the red-hot lime be drawn through the bars, as that would have the same injurious effect.

Gilmerton Limeworks, near Edinburgh.—It was here stated that the *sow-kilns* took *less coal*, and that a kiln was erected here too high for burning lime, which is contrary to the general opinion.

East Camps, Linlithgowshire.—Sow-kilns are used, but disapproved of as requiring more coal and labour. This limestone is carried to Shotts, and used at the ironworks, eighteen miles distant, and the burnt lime is preferred in Edinburgh for purifying gas.

Wester Camps, Linlithgowshire, belonging to the Earl of Morton.—The kilns were stated to be the best in the country, being fourteen to eighteen feet wide at the top, with three eyes, and about thirty feet deep. The rock is blasted with one and a half inch jumpers. Two men are employed to bore, one with a double-handed hammer of 15 lb., and the other a single-handed hammer, who turns the jumper.

Mansfield Limeworks.—Lime rock, exactly similar in appearance and texture to that on the water of Girvan, is worked on the estate of Mansfield, belonging to C. G. Stuart Menteth, Esq. This rock is in two beds, about twenty-four feet in depth, the upper embedding a portion of coarse limestone called kingle, containing a great portion of sand; the under bed is of pure limestone of fine grain, and crystalline texture, and sometimes columnar. It is situated on the north side of Corson-Cone Hill, a conglomerate mountain, on the confines of the counties of Ayr and Dumfries. The limestone contains no organic remains. This quarry has been mined for many years, and, from its compactness, the rock requires to be entirely blasted with gunpowder. The kilns are much upon the principle of those at Closeburn already described. The lime is supported on a grate of two-inch square iron bars, with doors to regulate the air through the kilns. It is brought down through the upper bars by a *poker* upon a grate of one inch space, to separate the lime-ashes from the shells, and from thence the lime is filled into the carts. The

coal is only two miles distant. The produce is fully one of coal to three of lime. The expenses of mining and carrying to the kilnhead is about 30s. per hundred bolls of two imperial bushels heaped. Burning, 4s., exclusive of coals and carriage; and all the work is done by contract.

The alteration of a kiln of the common construction to that of Mr Stuart Menteath's, is very simple. A limekiln at Mansfield, eighteen feet wide at top, three or four at bottom, with three eyes, was altered thus: the front eye was built up, and the bottom of the kiln widened to seven feet in diameter, in which a mid partition was built to the height of four feet, and upon which the mid bar of four-inch square iron rests; another bar of the same size was fitted into the wall on each side, upon which four bars on each side of the partition, of one and a half-inch iron, rest, and fixed to the mid bar by a strong moveable nail, to support the lime in the kiln. This kiln is only ten feet wide at half-way up, and eight at the top, and lined with bricks about fifteen feet deep. A saving of one-fourth of fuel in burning a given quantity of lime has been the consequence; and it will give out a greater quantity of limeshells in twenty-four hours, more equally and better calcined, and with less labour to the limeburner, than any ordinary kiln in the county of Ayr.

General Observations regarding the Working of Lime Quarries.

Quarries wrought open-cast.—This is done by removing the earth and superincumbent strata, commonly called *baring*, and afterwards quarrying out the rock by blasting with gunpowder, and the use of picks, levers, &c. Mr Loudon, in his *Encyclopædia of Agriculture*, says,—“The working of quarries is a simple operation, and one depending more upon strength than skill.” This is erroneous, as considerable skill and experience are required, not only in blasting rocks and putting in the charge where it will take the greatest effect, but also in the use of the lever and mell and large hammer.

These will be seen to far greater effect in the hands of a skillful quarryman, than in one inexperienced, be he ever so strong. A considerable saving in jumpers and hammers would be effected, by introducing the *churning jumpers*, and generally boring deeper, and applying heavier charges. In some quarries in Cumberland, the *bores* are paid by the foot, and the jumper, about one and a half to two inches in diameter, is put down to six or eight feet, through several beds of rock, by which a greater quantity of rock is detached at a time. This is not always practicable, but in many quarries it is worth a trial, while it also makes the borer his own master. By far too little work is done by the piece or job throughout the quarries, and too much upon days' wages.

Many of the lime quarries in Scotland are run over by not being properly opened up at the beginning, or they are drowned with water, or blocked up in the bottom. No quarry can be wrought to advantage if not kept clear of rubbish ; and any quarrier will soon lose more by working in a confused and blocked up quarry, than in the expense incurred in removing rubbish. When first opened, the rubbish should be carried to a proper distance, taking care not to lay it down where rock may afterwards be found. Letting open-cast quarries to tenants from year to year is a bad system, as tenants have no inducement to be at the expense of clearing out the quarry for more than the year, and the proprietor is sure to have the quarry blocked up at the end of the season. No improvement has been made in the working of lime-quarries or in burning limestone for a century, and it is lamentable how deeply quarrymen's prejudices affect improvements ; for nothing short of force, not even their own interest, will induce them to give new suggestions a fair trial ; but prejudices are not peculiar to quarriers. The bare is generally removed on wheel barrows, which is much the cleverest way when the distance is short, but when the distance is great enough to employ horses, a railway should be laid down. One-inch

square iron nailed to wooden sleepers would serve the purpose; as also for carrying the stones to the kilns. These roads require little repair. Engines are often employed to draw water; when such are necessary, care should be taken to place them so as they might be employed to draw waggons of limestone out of the quarry to the kiln-head upon an inclined plane.

Mining.—This operation requires still more skill and experience than raising limestone open-cast, and is frequently very ill executed. The operation of mining at Closeburn is perhaps the best executed in Scotland. The several beds of clay or marl interposed in the centre of the lime-rock, admitting of being removed by the pick, greatly assist the quarrying and lessen the expense. About three to four feet in the centre of the post, is removed to a considerable extent, and the roof about four feet blasted down, the rest being raised as in an open quarry. In a small bed or post of limestone where the roof and pavement are equally hard, the least expensive way is to go in at the bottom, and the upper part is then easily brought down. In large and compact posts of lime-rock, the top of the post is the best place to begin, as there is no parting in the limestone from top to bottom; and it is too high to be reached from the bottom without scaffolding which should never be used when it can be avoided. In taking out the top of a large post of lime-rock, the miners should go in ten to thirty yards before taking up the bottom, and then they see how to work it to the best advantage. In most of the quarries the pillars are too small, thereby not only endangering the lives of the miners, but often breaking down and causing great expense in re-opening. The size of pillars and breadth of rooms must always be in proportion to the strength of the roof; at the same time it may be mentioned, that a hard material like lime-rock cannot be worked profitably when the roof will not stand to be wrought pretty wide.

Machinery.—Scarcely any machinery has been erected to convey the limestone to the kiln-heads which are generally at a considerable elevation above the bottom of the quarry.—At Closeburn, a water-wheel is employed to draw the water out of the mine, and the limestone to the kiln-head upon a double inclined plane. Steam-engines are employed in the lime-quarries near Whitehaven; a horse-gin near Mid-Caldar; asses with buckets carry the stone on their backs out of the mines near Gilmerton, and common carts are universally employed. Iron railways are used in very few quarries.

Kilns.—Little attention has been paid to the construction of lime-kilns throughout Scotland, and much prejudice has yet to be overcome before a general improvement can be effected in them, and it is unfortunately in the power of every lime-burner to frustrate any experiment by giving too much, or too little, coal in the filling. Mr Stuart Menteath's lime-kilns are the best yet introduced.

The small draw-kilns constructed on the Closeburn plan, are much the best and most economical in every point for a country sale; they should be carefully lined with the best fire-brick, which greatly assists in retaining the heat, and, if the brick is good, will stand eight or ten years without repairs; whereas when lined with stone they require to be rebuilt almost every season. Great pains should be taken to have all the stones broken to the same size, and the kiln at no time to be drawn lower than about three feet below the mouth; and no lime should be drawn when the red-hot lime shells approach to the bottom of the kiln. The stones should be carefully measured in a bucket and thrown into the kiln to the depth of one foot or sixteen inches; and the regular proportion of coals measured in the same bucket and thrown upon the top; and so continue to keep the kiln at the top. In caking coal, it may be necessary to mix the lime and coal as much as possible, to prevent it caking and stopping the draught in the kiln. A caking coal, which retards

the circulation of air, would be more profitably used if it were charred before being put into the kiln.

Coal should not be too small, as stopping the draught of air through the kiln; large pieces are equally bad, taking too long time to burn. Coal is never seen to flame in a lime-kiln, owing to the great discharge of carbonic acid gas from the limestone in the process of calcination, and this may account for the same bulk of charcoal, and coal, burning equal quantities of lime, and the superiority of blindcoal or anthracite over either. In general the proportion or quantity of coal required to burn a given quantity of lime is given in tons; but it must be understood that the bulk of a ton of limestone has no proportion to the bulk of a ton of coal. The proportions should therefore be always given in measures. The advantage which the Closeburn kilns have over those commonly employed in Scotland is as three to two.

The burning or calcining of limestone is one of the most important operations connected with lime-quarries, and it is one on which the least satisfactory information can be procured. Indeed very few great trials have been made to ascertain the best constructed lime-kilns, and the exact quantity of coal required to calcine a given quantity of lime. Prejudice in favour of the old plan exists to such a degree amongst lime-burners, that the truth, or even a trial, can only be obtained by chance, or with the greatest difficulty. In trials, much depends upon the construction of the lime-kiln, the quality of the coal, and the density of the limestone, yet it is the interest of every proprietor and every person connected with lime-quarries, to have satisfactory experiments made on a large scale with a view to economize fuel and have the limestone well and properly burnt.

IMPROVEMENT OF WASTE LAND.

Report of the Expense of reclaiming Land on the farm of Wester Moy, in the parish of Contin and county of Ross, the property of J. A. Stewart Mackenzie of Seaforth, Esq. M.P., by Dr James Wishart, Dingwall.

THESE lands, in their natural state, consisted of an almost impenetrable copse of whins and broom, interspersed with deep gullies and patches of rock, which could only be reduced by the application of gunpowder. When properly cleared and levelled, the whole ground was completely drained, and afterwards carefully trenched to the depth of fourteen inches. After these operations, the whole was limed at the rate of thirty bolls per acre, and are now subjected to the same rotation of crops as the rest of the farm, and are equally productive,—all done in the course of three years. The land has been converted to very productive soil.

The contents of the reclaimed land are 41 imperial acres, which, for clearing of whins, levelling and removing rocks, cost 10s.

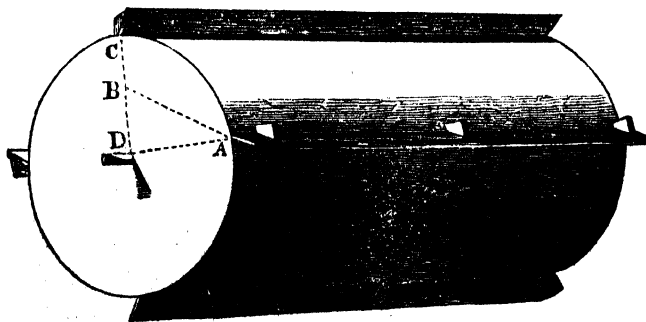
per acre,	L. 20 10 0
Draining and ditching 41 acres, at L. 2 per acre,	82 0 0
Trenching 41 acres at L. 4, 16s. per acre,	196 16 0
Liming 41 acres at the rate of 30 bolls per acre, amounting to 1230 bolls at 3s. per boll, including cartage from the port of Dingwall,	184 10 0
Total expense,	<hr/> L. 483 16 0

IMPROVEMENT IN THE MODE OF PLACING THE SCUTCHERS ON THE DRUM OF THE THRASHING MACHINE.

THE last finish to any human invention, is observed to be given with less frequency as the invention approaches to maturity. This remark applies exactly to the thrashing-machine. Since Meikle brought that machine to nearly its present state, no material improvement has been effected in it; a little may have been effected now and then, but no important fea-

ture has been added. In some parts of England, it is true, changes of a more marked character have been attempted in the machine, such as dispensing entirely with the feeding-rollers, and giving a velocity of revolution to the drum, from two to three times higher than is the practice of the Scottish millwrights; reducing at the same time the dimensions of the drum about one-third. Whether this be an improvement has not been satisfactorily determined, though it is alleged that machines on this principle do more work with a given power than those that are fitted with feeding rollers.

The foregoing remarks have arisen from a consideration of the improvement which has been brought before the Society by Mr Hope of Fentonbarns, East Lothian, which forms the subject of the present notice. About three years ago Mr Hope had conceived the idea of altering the position of the scutchers upon the drum, and having effected the alteration, he found that the machine was worked with more ease, and that the work was better done than in the old state. The success of Mr Hope's experiment induced some of the neighbouring farmers to make trial of the improvement. One of these gentlemen altered no less than three of his thrashing machines, and from the certificates given by these gentlemen, they appear amply satisfied with the improved effect of this new position of the scutchers.



458 *Lord D'Eresby's Machine for Compressing Peat Moss.*

The annexed cut, exhibiting the thrashing drum in perspective, apart entirely from the machine, will give an idea of the improvement. In the old position, the scutchers are placed on the drum, with the planes of their striking faces coinciding with the radii CD or AD of the circle of the drum. By Mr Hope's improvement, the external edge of the scutcher is thrown forward till its plane coincides with the line AB, which bisects the radius CD, which is at right angles to AD, the radius on which the scutcher stands; this will be evident on inspection of the cut. No other alteration being required in fitting thrashing machines with this improved scutcher, the experiment can be made at a very small expense, and, from the respectable quarters from which the alteration is recommended, there can be no doubt of its merits.

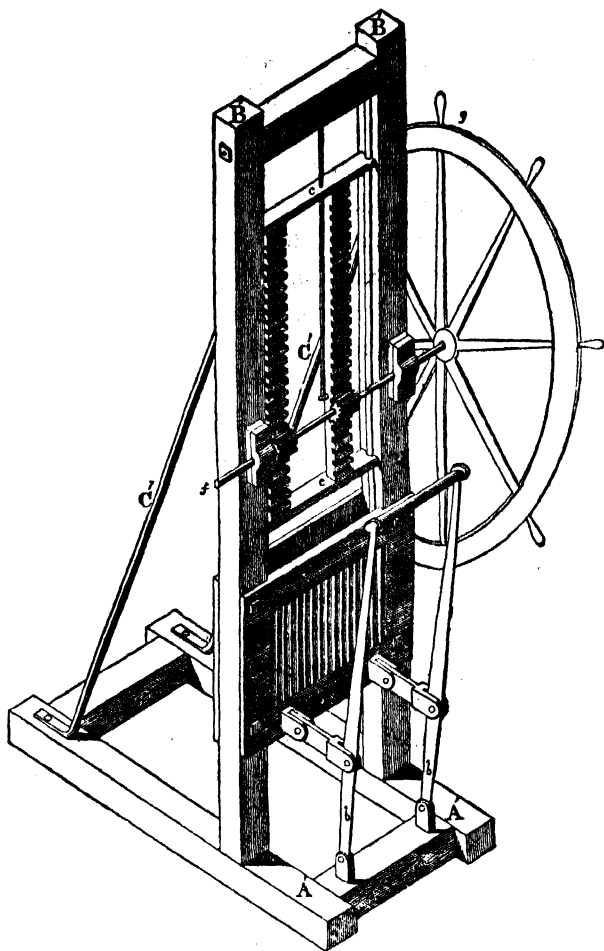
From Mr Hope's report it also appears that a thrashing machine mounted with the improved scutchers, and impelled by a steam-engine working at a power of six horses, is capable of thrashing and cleaning 60 bushels of oats per hour.

MACHINE FOR COMPRESSING PEAT-MOSS. *Invented by the Right Honourable Lord WILLLOUGHBY D'ERESBY.*

THE important subject of determining the best and most economical means of rendering peat-fuel more effective for domestic and manufacturing purposes, has of late excited the attention of many individuals. Among these we have now to enrol the name of Lord Willoughby D'Eresby.

His Lordship has invented a machine which will facilitate the manufacture of peat-fuel, and improve its quality. It is represented in the annexed cut; but his Lordship does not consider it perfect, and is still engaged in adding to its efficiency by effecting further improvements upon it; but it is in such a state as to warrant its application to the intended purpose.

As will be seen, by referring to the cut, where the machine



is shewn in isometrical perspective, it is composed of a sole-frame A A, and two uprights B B, with a cross bar at top, all of timber, and with two iron stays C C, to support the uprights. Upon the two uprights is bolted the receiver D D, formed of two plates of cast-iron, placed one on each side of the frame. The plates of the receiver are perforated with very narrow vertical grooves or slits, formed at distances of

460 *Lord D'Eresby's Machine for Compressing Peat-Moss.*

one-half inch apart, and so narrow as to retain the moss, while they allow the expressed water to escape. Their width is about one-fiftieth of an inch, on the inside, widening into vertical channels, opening outwards only at top and bottom, though in the figure they are, for the sake of perspicuity, shewn as open throughout their whole length. A plate of cast-iron is fitted to slide backward and forward in the slit *a*, and forms the bottom of the receiver. It is moved by means of the upright levers *b b*, jointed at their lower ends, and to the sliding bottom by shackle joints. *c c* is a moveable frame, composed of two racks, connected at top and bottom by the bars *c c*. The lowermost of these bars is fitted to slide tightly, but easily, into the receiver, the racks being acted upon by two pinions placed upon the horizontal axis *f*, which is turned by means of the spoke-wheel *g*. The rod passing through the upper bar of the frame at *c*, with its shifting nut at bottom, serves to regulate the size, in depth, to which the peat is to be compressed, by stopping the upper bar of the sliding frame when it has made the desired descent. The process of working is as follows:—The moss is cut with a proper spade into blocks adapted to the size of the receiver, into which they are thrown by one at a time; the spoke-wheel, which is then turned round, bringing down the sliding frame, until its lower bar presses on the contents of the receiver. The surplus water is thus squeezed out, escaping through the slits of the receiver. When the pressure has been sufficiently exerted, the slip-bottom is withdrawn, and the peat falls out ready for removal to the drying shed. As soon as the peat is discharged, the slip-bottom is returned to its place, the sliding frame is raised, the receiver charged with another block of moss, and the operation repeated.

[It is indisputable that cattle fed in open hemmels preserve their coats against the weather, and their feet for travelling, much better than when fed in close byres ; but the comparative profit derived from both kinds of feeding has never before now been ascertained with accuracy. The Society's Gold Medal has been awarded for the following experiments.]

ON THE COMPARATIVE ADVANTAGES OF FEEDING CATTLE IN CLOSE BYRES AND OPEN HEMMELS. *By JOHN BOSWELL, Esq. of Kingcausie, Kincardineshire.*

I PUT aside sixteen oxen, for the purpose of ascertaining the comparative advantages of feeding cattle in close byres and open hemmels, in the autumn of the year 1834 ; and the better to ascertain the merits of the two modes of treating the animals, I resolved to carry it on in two sections, viz. eight on the farm of Balmuto, and eight on the farm at Kingcausie ; and still farther to vary the experiment, those on the Kingcausie farm were a year younger than those set aside on the Balmuto farm, each eight being of the same age, and as near as possible the same in quality and size. The cattle were weighed in presence of Sir John Oswald of Dunnikier, and Mr Dick, lecturer to the Society, at Balmuto ; and at Kingcausie in presence of Alexander Thomson, Esq. of Banchory, and Robert Alcock, Esq. advocate, in Aberdeen.

The cattle were inspected during the progress of the experiment by many members of the Society, and numbers of practical men. From the result of my own experiment, as further detailed below, as well as the unanimous opinion of every agriculturist with whom I have conversed on the subject, I feel convinced that there is no point more clearly established than that cattle improve quicker, or, in other words, *thrive better*, in *open hemmels* than in close byres. I must, however, add the following observations:—Hemmels ought never to be

used unless where the climate is good and the accommodation of courts dry and well sheltered, and, above all, unless where there is a very large quantity of litter to keep the cattle constantly clean and dry. Previous to entering on the experiment it was my own opinion, as well as that of the best informed men with whom I conversed on the subject, that the four young cattle would thrive better in the hemmels than the older ones, it being supposed that the byre would prove much more irksome to the young cattle, to which exercise and the free use of their limbs might be considered absolutely necessary. The result of my experiment at least does not shew this, nor do I think that, with the greatest care, young cattle can be made to lay on fat so quickly as older animals,* the trivial matter of being tied up or at liberty not making much difference. The young cattle fed at Kingcausie did not get potatoes, as potatoes being of a very purgative nature were not supposed to be so beneficial for young stock, but the straw and turnips were of the best sorts. I have not loaded this report with the daily weights of food; the only thing worthy of notice being that all the sixteen cattle ate rather less weight of turnips per day as they got fat.

I. *Kingcausie Farm.*

Four oxen, 2 years off, put into hemmels to feed on the 17th October 1834,

No.	1 weighing	cwt.	9	1	7
2	—		9	0	21
3	—		10	3	7
4	—		10	3	0

Total weight when put up,	}	40	0	7
(Carried forward)				

* The statement given below tells rather in favour of the feeding powers of the young cattle. In the hemmels at Kingcausie they gained in the same time 5 cwt. 2 quarters 22 lb. on 40 cwt. 7 lb., that the older cattle in the hemmels at Balmuto gained 5 cwt. 3 quarters on 43 cwt. 3 quarters. Moreover, the young cattle in the hemmels at Kingcausie gained 1 cwt 2 quarters 15 lb. over those in the byre, thereby leaving a profit of L.2, 18s. 2½d. for hemmel feeding, whereas the older cattle in the hemmels at Balmuto only gained 1 cwt. 1 quarter over those in the byre, leaving only a profit of L.1, 17s. 6d.—ED.

		Weight brought forward,	40	0	7
On Feb. 19, 1835, No. 1 weighed	cwt.	10	2	4	
2	—	11	0	14	
3	—	11	3	11	
4	—	12	1	0	
			45	3	1

Weight gained in hemmel, 5 2 22

Four oxen, 2 years off, put into the byre to feed on the
17th October 1834, No. 1 weighing cwt. 10 0 0

2	—	9	3	0
3	—	11	1	7
4	—	8	2	0

Total weight when put up, 39 2 7

On Feb. 19, 1835, No. 1 weighed	cwt.	11	0	14
2	—	11	1	0
3	—	11	3	0
4	—	9	2	0
		<hr/> 43 2 14		
		<hr/> 4 0 7		

Difference in weight gained in hemmel, 1 2 15

Which at 48s. amounts to L.3 12 0½

Straw consumed in hemmels unlimited, of yellow turnips
from Oct. 17. 1834 to Feb. 19. 1835, tons 27 0 1 1

Straw consumed in byres, 1 stone per beast

per day, and of yellow turnips, 25 12 2 23

1 7 2 6 at 10s. 0 13 9½

Money gain by hemmels, L.2 18 2½

II. *Balmuto Farm.*

Four oxen, 3 years old off, put into hemmels to feed on
the 28th Oct. 1834, No. 3 weighing cwt. 11 2 0

5	—	10	3	0
7	—	10	3	0
8	—	10	3	0

Total weight when put up (carried forward), 43 3 0

(L 1 2)

464 On Feeding Cattle in Close Byres and Open Hemmels.

		Weight brought forward,	43	3	0
On Feb. 28. 1835, No. 3 weighed,	cwt.	13	2	0	
5 —		11	3	0	
7 —		11	3	0	
8 —		12	2	0	
			49	2	0
		Weight gained in hemmel,	5	3	0
Four oxen, 3 years old off, put into the byre to feed on					
28th Oct. 1834, No. 1 weighing,	cwt.	9	2	0	
2 —		10	0	0	
4 —		11	2	0	
6 —		11	3	0	
			42	3	0
On Feb. 28. 1835, No. 1 weighed,	cwt.	10	3	0	
2 —		10	2	0	
4 —		13	1	0	
6 —		12	3	0	
			47	1	0
			4	2	0
			1	1	0
			L.3	0	0
Which at 48s. per cwt. amounts to					
Straw consumed in hemmels unlimited, of					
yellow turnips, from Oct. 28. 1834, to					
Feb. 28. 1835,	tons	22	17	0	0
Straw in byre, 1 stone per beast per					
day, of yellow turnip,					
		20	12	0	6
		2	4	3	22 at 10s.
			L.1	2	6
		Profit on hemmels,	L.1	17	6
		Profit on hemmels at Kingcausie,	L.2	18	3½
		Balmuto,	1	17	6
			L.4	15	8½

4 Tons 15 cwt. potatoe weres given to both byres and hemmels at Balmuto.

ON THE REFUSE OF HERRINGS AS MANURE. *By Mr*
RODERICK GRAY, Peterhead.

[The Society's Honorary Silver Medal was voted for this Essay.]

PETERHEAD being situated on the most easterly point of land in Scotland, it is natural to expect, that as long as herring pass along the coast, either from the north or from the deep sea to spawn, it must be nearer the shoals of herring than any other station. Impressed with this idea, the writer of this notice was many years ago anxious to induce curers and fishermen to make Peterhead a station for the herring fishery. The objections stated against it were, that the tides were too strong off the headland; that the sea was rough in comparatively easy weather; that the herrings were at times at such a distance from the shore, as to render it hazardous in such a sea to fish in open boats, especially as there was no light to direct the fishermen in their course during the night, or enable them to return in the morning. At length, in 1819, a company was formed to make a trial on a limited scale; and in 1820, four boats were engaged, and about 890 cranes of herrings were caught. In 1821 and 1822, the fishing proved successful. The fact having been thus established, which they originally had in view, that there were plenty of herrings to be had off Peterhead, the company was dissolved in 1823. Since then the fishery has gone on to increase, and during this present season (1836), 262 boats have been employed, and the quantity of herrings caught amounted to upwards of 40,000 barrels. Every accommodation to the curers has been afforded by the trustees of the harbour and the governors of the Merchant Maiden Hospital, the superiors of the town.

Besides the employment of labour and capital, the herring fishery at Peterhead has added much to the agricultural prosperity of the adjoining districts. It has been established that the refuse of herrings is equal to any other manure hitherto

made use of, and it may be carried to a considerable distance from the coast at little expense. The refuse of the herrings caught by one boat will, along with the dog-fish, on an average, be sufficient manure for two acres of land. It follows that upwards of 500 acres have in the present season been manured from the refuse of the herring fishery at Peterhead, and of course the produce of the land thus manured in the neighbourhood must ultimately be greatly increased.

ON THE WHIN AS A FENCE. *By WILLIAM BELL, Esq. of Hunthill, Roxburghshire.*

[The Society's Honorary Silver Medal was voted for this Essay.]

THE use, or perhaps to speak more correctly, the abuse, of the whin for fences to fields and plantations, is of ancient origin. Whin fences are to be seen in all parts of the country around plantations, and their general condition is such, as to induce no wonder that the whin has not been more extensively cultivated for fences to fields. Sown on the top of an ill made and worse preserved turf dyke, these fences have been left to grow as nature dictated, and to contend with every disadvantage, presenting a rugged aspect, and spreading over an inordinate breadth of land, breaking down with snow, and pernicious to cattle in every direction; good for nothing as a fence, and a harbour for all sorts of vermin or weeds.

This very abuse of it has proved the plant to possess important and valuable qualities as a sole or component part of a fence. Quick in growth, hardy, easy of culture in all dry, lightish soils, of unknown longevity, prospering under the knife, affording as an evergreen a pleasing object to the eye, the best shelter for stock, adapted for food, and not suffering, but rather benefiting, from being cropped, the whin is peculiarly well calculated for a fence.

Impressed with this conviction, I venture to describe all the whin fences at Hunthill near Jedburgh as excellent. In their original formation, subsequent rearing, and future preservation, they have been more economical than other descriptions of fence; they are less liable to blanks, and the blanks are more easily repaired; they afford more shelter; equal or surpass in beauty the privet in summer; and in winter they are a complete fence against every description of stock, affording less lodging for small birds and vermin than the common thorn hedge.

Having observed the general properties of the whin, and being desirous to test its longevity, capabilities for a fence, and ability to bear the knife, and not wishing to incur unnecessary expense, or run the risk of planting a fence which might not succeed, I caused some old whin fences to plantations, which had been made in the year 1790, and which had got into a straggling state usual in such situations, to be switched up, like the common thorn, for several years. They soon assumed a regular shape, became compact, close at the root, vigorous in growth, the blanks, where not too large, closing up; and although it was impossible to confine them within the ordinary compass of a common hedge, having spread over much land, yet it was clearly demonstrated that the experiment was worth farther prosecution. This was twenty-five years ago, and as the fence was then upwards of twenty years old, during which several very severe winters had occurred, the hardiness and longevity of the plant in such situations were thus well ascertained.

In the prosecution of the experiment, the first plan tried was in the form of a double-faced three-feet-turf dyke, with a ditch on each side. This was made betwixt two grass fields in the year 1814, and the whins were sown in two rows on the top. The only fence required was a single bar of paling on the top of the dyke along each side. The whins prospered well, and in three years were a complete fence. At first the cattle

while depasturing in the fields, rubbed the sides of the dyke, but some of the longest plants being pinned down along the side when the hedge was switched, the whole dyke was so completely covered that it could not be seen. In that state the fence has remained to the present day, being fully six feet in height, with not so much as a single blank having occurred.

It is obvious that this form of fence, occupying much ground, is suitable only for poor situations where land is not valuable. It has not therefore been much used except for march fences, for which, by its strength, solidity, and durability, it is peculiarly well calculated. If used in other situations, the best height for the dyke is 18 inches to 2 feet, the breadth at bottom $4\frac{1}{2}$ feet, and at top 2 feet, with ditches to correspond, and one row of whins sown on the top about the 1st of May. The cost in this part of the country is 1s. 3d. per rood for the dyke; two-bar paling (on low dykes one on each side), 1s. $2\frac{1}{2}$ d. per rood, and seed 1s. for 20 roods.

The next, and rather a curious experiment, was made with an old thorn hedge, planted in 1790, which had defied the care and attention of every successive hedger. It was eaten up with the yellow canker, and was rather a straggling collection of stunted thorn plants, than what might be termed a hedge. The whin was sown at the back of the hedge, which came up freely, and, in place of injuring the thorn, it put forth fresh shoots, became healthy and vigorous, and a strong fence in a few years.

This experiment led to the free and frequent use of the whin in all similar situations. After the whin has come to its strength, that is in four or five years, no more care is necessary than the ordinary cutting nor paling required, a source of expense in all weak hedges. The cleaning, also, is an important consideration, the whin growing so close at the bottom, as to supersede much of this tedious and expensive process.

The whin has also been tried sown with thorns when first planted, but it is rather apt to hurt young thorns, which

should therefore be allowed a start of three years. When an old thorn dies out, the whin soon fills up the gap.

It has also been tried by itself, as a fence, without a turf-dyke, planted as thorns; and bating the additional strength which the stem of the thorn gives, to resist the push of heavy cattle, it makes an equally good fence in five or six years. It has been sown on the top of the ordinary dyke, as made for a thorn-fence; and young plants of it have also been planted in the side as thorn-plants, and seed sown on the top.

By actual measurement, a well kept fence of thorn and whin, or of whin alone, does not exceed the breadth of a thorn hedge by more than six or eight inches; and, as the field may be ploughed close to the root where a ditch is not required for draining, the actual loss of ground is trifling. Those who apprehend the loss of ground by the use of the whin as a fence, should contrast it with the saving of expense in forming and keeping whin-fences. The length of the fence round a field of 40 Scotch acres, is just a mile or 1760 yards. If the whin-fence takes even a foot more space than a thorn-hedge, the extra space occupied is 587 square yards, or rather more than the tenth part of an acre, worth in land valued at L. 3 per acre, just 6s. per annum, or at thirty years' purchase L. 9. The saving of only a shilling per rood in the forming of a mile of fence (and the actual saving is vastly more) amounts to nearly L. 15, while the ground supposed to be lost, has been shewn to be worth only L. 9.

The whin should be cut every year after the third, in the months of May and June, or September or October. The usual form of a well kept thorn-hedge is the best. It is more easily cut than a hedge of thorns alone. The height will depend upon the description of cattle kept; it is often left higher than a man can see over—fully six feet.

When snow is on the ground, sheep crop the twigs of whin, but this rather benefits than injures the plant, except in a snow-drift, when the sheep may eat down and trample it.

But this nature soon repairs. Such a catastrophe happened once extensively in a kind of fence I do not recommend (a round mound cast out of two ditches, and three rows of whin sown on the top), which was drifted over, eaten down from the top, and apparently ruined ; but after being only protected for two years, it became as good as ever. A very severe frost affects the outer shoots, but the effects disappear early next summer.

With regard to soil, the whin does not appear to be much affected with minor differences, if kept reasonably dry. A great extent of fence was made on the top of turf-dykes some years ago, on a sheep-walk at the sources of the Liddal in Roxburghshire, a part of the country remarkable for the scarcity of naturally-planted whins, and it has prospered extremely well. This district is also of great elevation, and where the winter is long and severe.

Independent of its beautiful appearance, the shelter the whin-hedge affords to stock in winter, is an important circumstance in its favour ; and its rapid growth and the speed with which it becomes a fence, is an essential saving in the article of paling. One course of paling will, in every instance, suffice ; and frequently the paling may be removed to other places before it is decayed.

Whin-fences never require to be cut down, and one reason why a plant so apparently fragile and yielding as the whin by itself is, forms an effectual fence, is, that there are no gaps inviting the cattle or sheep to push through, and they present an equally close surface in winter as in summer.

The ordinary idea, that the whin injures the adjoining land by scattering its seed, is not verified when they are regularly trimmed. One reason of this may be, that the whin bears its seed on wood of two years' growth, and therefore any slight bloom that takes place is in the interior of the hedge, where either the seed does not ripen, or if it does, it falls at the root of the hedge itself.

These experiments have now stood the test of a great num-

ber of years, and have extended over a great length of fences, of the several kinds which have been described ; and if they shall be found to warrant the adoption of whin as a fence, I have confidence that the results will be beneficial to the country.

DESCRIPTION OF A CONICAL AND GROOVED PULVERIZING LAND-ROLLER. *By J. STEWART HEPBURN, Esq. of Colquhalzie.*

IN tenacious soils which have been ploughed in a wet state, and even in soils of a looser texture, when the cohesion of the clods and masses of earth is aided by a certain degree of moisture, the common cylindrical roller is apt to press them in an entire state into the yielding soil, which consequently remains in a rough condition until it is reduced by repeated ploughings and harrowings. To remedy this imperfect action of the roller, I propose to flute it transversely, and to increase its effect on tenacious soils by giving it a variation of form,—that of the truncated cone,—in the manner now to be described.

I. *General Description.*—The mechanical principles upon which this roller is constructed, admit of several modifications, and of three distinct forms, the transverse groove being common to them all. The *first* and simplest is a cylindrical roller of the ordinary dimensions, grooved transversely, adapted to light soils ; the *second* is a double conical or bevelled roller also grooved transversely, for the working of strong soils ; the *third* is the same roller with the axles bent forward, and the grooves cut into teeth across, or in a diagonal direction, intended for soils of the hardest and most tenacious kinds. To each of them a scraper or cleaning-rake is applied, to maintain the continuity of the effective action of the groove which would otherwise be obstructed or neutralized by the adhesion of soil.

II. *Principles of Construction.*—1. The common cylindri-

cal roller acts solely by pressure. The effective pressure of a given weight being inversely as the bearing surface, the effect will be increased in the same proportion as the surface is diminished. Thus, if a board containing 100 square inches of surface, be placed on the ground and loaded with a weight of 100 lb., each square inch of the subjacent earth will sustain a pressure of 1 lb. But if the same board be raised on four feet each of 1 inch square, each foot will press the portion of ground under it with a force of 25 lb. In like manner, if a common cylindrical roller, weighing 50 stones, and pressing equally on the ground throughout its whole length, be broken transversely into alternate grooves and bands of 1 inch in breadth, the relative action of the same weight will be doubled, or the ground under the bands will be pressed as with the weight of 100 stones,—that is, one-half of the same extent of ground, divided into intervals sufficiently short to pulverize the whole of it, is pressed with the whole weight of the roller of 50 stones. If the bands, again, be made $\frac{3}{4}$ inch, and the grooves $1\frac{1}{2}$ inch, the pressure will be trebled.

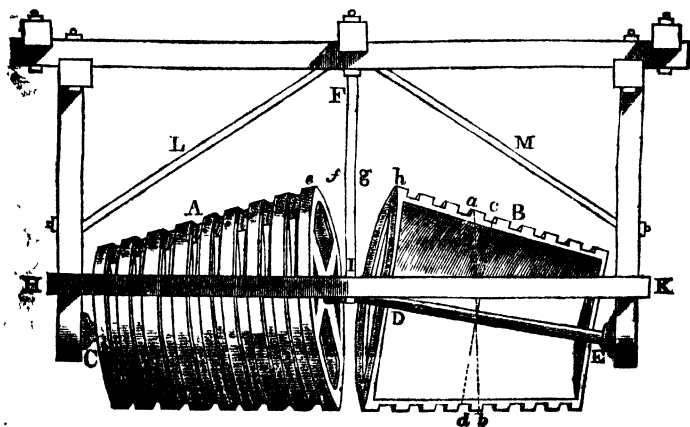
2. If a conical form with an inclined axis be given to the grooved roller, its action becomes more complex, but at the same time more effective. Let us suppose the conical roller to be cut perpendicular to the axis, into as many circular plates as there are bands, each turning independently on the same axis; then, as the roller is drawn along, each plate would revolve with a different velocity; and, while the central plate revolved with a mean velocity equal to that of the rectilineal progressive motion of the machine, the plates toward the base of the cone would revolve *slower* in the same proportion as their respective circumferences exceeded that of the central plate, while the plates toward the truncated end revolved *faster*, in the proportion of the diminution of their circumferences. The plates at the same time would have a small angular motion laterally; for as the plane of rotation, *cd*, Fig. 2, does not, owing to the obliquity of the axis, coincide with the plane *ab* parallel to the line of traction, but in-

tersects it at the centre, these planes are continually crossing each other ; the deviation longitudinally in a semi-revolution amounting to about 4 inches. Suppose now that the roller still moving forward, the plates composing it are suddenly reunited into a solid conical body ; the extremities, compelled to assume the mean velocity of rotation, must press the ground with a rubbing action, the direction of which towards the larger end—now forced to turn faster than the rate due to its relative circumference—is *backwards* ; while that of the smaller end—now compelled to revolve slower—is *forwards*. Another quality of the conical roller, depends on the circumstance resulting from its form,—that if, when propelled forward, the rollers were allowed to revolve independently, each on its own axis, they would roll *outwards* in a wide circle, of which the centre would be the vertex of the cone of which the roller is the frustum, or the point in which the prolongation of the sides would meet. But if, in place of being allowed to revolve in a circle, the cone be forced to proceed forward in a straight line, it is evident that its constant tendency to turn outwards, will have the effect of grinding and pressing outwards the yielding surface over which it rolls. This, in fact, is just the converse of the action of the cylindrical edge-mill-stone used in oil-mills, which would naturally roll forward in a straight line : but being compelled by a central axle to move round in a circle, operates with not merely a *bruizing* but a *grinding* action on the linseed subjected to it. This double action must obviously much augment the pulverizing effect, especially if the bands be broken crosswise into teeth. But, as the cleaning-rake cannot be applied to keep these teeth clear of the adhesion of soil, they must either have the form of a shallow concave, to which the soil will not readily adhere, or, if more deeply cut, drawn in an angular direction so as to be kept clear by the friction itself.

3. The *third* form of the roller is an alteration of the second, effected by merely bending the inclined axis forward, at an angle equal to that of its inclination, until the fore part

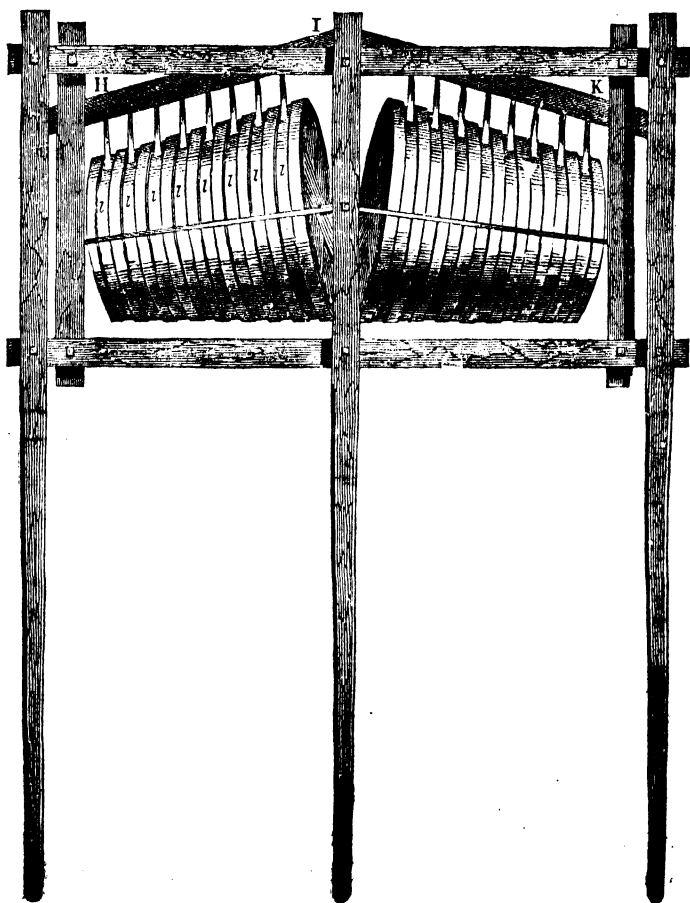
of the circumference of the rollers is brought into a straight line, perpendicular, consequently, to the line of traction. This small deviation in the set of the axle produces an important change in the action and effect of the roller. In the *second* form, the axle being perpendicular to the line of traction, the grooves revolved in a direction parallel to that line, though oblique to the surface of the ground. Now, however, they are forced, while moving forward, to revolve in a plane which cuts that line at a small angle; by which means there is superadded to the bruising and rubbing action of the roller a peculiar *twisting* motion, which tends to tear, lift, and throw outwards the yielding surface exposed to its operation. Accordingly, when the small model-roller* of the third form is drawn along a stratum of fine sand in a slightly moist state (to give it a small degree of cohesion), the furrows formed by the bands are visibly torn up and thrown outwards in a small degree. Its pulverizing effect may therefore be assumed to be considerably superior, not only to that of the common roller, but to the fluted roller of both the forms above described.

4. *Details of Construction.*—Fig. 1. is the back elevation of the roller with its frame. In the full size the rollers are



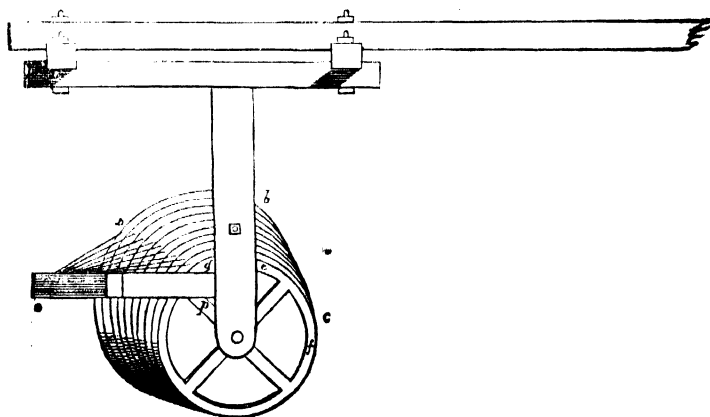
* We believe the rollers here described have never yet been tried in practice.—E.D.

30 inches in diameter at the larger, and 22 at the smaller end, and each $2\frac{1}{2}$ feet long, having a deviation from the vertical $e f$, and $g h$, of 4 inches. A is one of the rollers in position, with its cleaning-rake, and B a section of the other roller, shewing the position of the axle and the relation of the lines of traction and rotation. The line $a b$, Figs. 1. and 2, represents



the vertical plane parallel to the line of traction, and the line $c d$ a plane perpendicular to the axes of rotation intersecting each other in the centre at an angle of 8° . The axle $C D E$

is bent diagonally forwards and downwards, so as to bring the under side of the roller longitudinally into a horizontal line flat on the ground, and the front side also into a straight line; it is supported in the middle by the forked braces *F G*, bolted through the upper frame. *L M* are a pair of diagonal iron braces to steady the uprights, through which the axle passes. *H I K* is a diagonal spar parallel to the axis, fixed on the horizontal arm, *o p*, Fig. 3. On this spar are fixed the iron scrapers *l l l*, which, attached to slender iron rods, work in the grooves of the roller to keep them clear of the adhesion of soil. These rods or necks should have a certain degree of elasticity to allow the scrapers to accommodate themselves to any casual inequalities, rotatory or lateral, in the motion of the roller. Fig. 2. is a ground-plan of the roller, shewing the manner in which the axle is bent forward, to give the roller a twisting action, and the manner in which the diagonal cleaning-rake is attached. Fig. 3. is a side view of the



roller in the line of the axle with the rake, *a b c*, being the circumference of the larger, and *d e f* that of the smaller end.

REPORT ON THE FAILURE OF THE POTATO CROP.

*To the Directors of the Highland and
Agricultural Society of Scotland.*

GENTLEMEN,—In the Report, which, by your appointment and at your request, I am now to submit to you regarding the Failure of the Potato Crop of recent seasons, it shall be my endeavour so to arrange the contents of the numerous and admirable papers, which have been transmitted to your Secretary upon this subject, as that they shall possess more of the character of practical instruction for future guidance, than of unprofitable speculation concerning the past. I agree entirely in the opinion, expressed by one of the writers on this subject, who remarks, that “to attempt to trace the causes of success, or failure, in all their different features and ramifications, would be endless and almost impossible.” Nor am I convinced, that any benefit would result to the agriculturists of Scotland from the announcement, that, after the perusal of sundry Dissertations, and a comparison of the replies to certain queries, proceeding from intelligent persons engaged in farming in different parts of the kingdom, the Directors of this Society had resolved to declare their conviction, that it was no longer possible to doubt from what cause the potatoes had fallen short in produce, and that they now pronounced their authoritative judgment accordingly. It may be said, “Is, then, all this investigation, into which you have led us, to end in nothing?” By no means; a great mass of valuable information has been communicated, and the opinions of practical men residing many miles apart, are now to be arranged in juxtaposition, so as mutually to confirm and illustrate each other; their joint influence, being the result of no common understanding, and suggested by no previous intercourse, ought, therefore, to induce attention to their counsels, since agreement in error, on points of practice and individual experience, may be held to be all but impossible.

The plan, which I have adopted in preparing this abstract, has been (1.) to note the points on which each writer touches, and his opinion upon it. (2.) To place together, under distinct sections, and in continuous order, the sentiments, and frequently the language, of the several writers regarding these several points. (3.) To sum up, at the conclusion of each section, the collective opinion of the whole, in so far as there seemed to be agreement; or, on the other hand, where discrepancies of sentiment presented themselves, to point out these; drawing, in either case, such general conclusion as might seem warrantable.

By this plan, a combined succession of precepts for the proper cultivation of the plant, —of opinions regarding its present condition,—and of the most likely methods for obviating, or removing, any weakness or disease which may be found to attach to it,—are given in a clear and definite arrangement, so that the views of the different writers upon each branch of the subject are seen at a glance, and the value of what they say can be at once appreciated. Trusting that the method which has been adopted may meet with your approbation, I now proceed, Gentlemen, to lay before you the following Abstract of the Documents which the Society has received regarding the Failure of the Potato Crop, and of such other information as I have happened to meet with upon the same subject, since I had the honour of learning your wishes.

§ I. The proper period for planting.

(1.) Mr Gillespie Smythe, of Gibleston, by Colinsburgh, Fife, considers the middle, or end, of April the best period. In his answers to the queries, he states that he planted from the 3d to the 26th May, and the earliest planted grew best.

(2.) Mr Thurnson, one of the gardeners to the Horticultural Society of London, is stated to have ascertained, by means of experiments, that the month of March is the best time.

(3.) Mr James Crozer sen., residing at 15 Brunswick Place, Newcastle-upon-Tyne, (a gentleman, who states, that, on the recommendation of the late Sir John Sinclair, when President of the Board of Agriculture, he received premiums from that Board for discovering the cause of Curl in the Potato) recommends as early planting, as from the first week in January to the middle of March, and says he has known not a plant to fail, when such a period was selected; while those planted from the latter date to the middle of May, became *progressively worse*.

(4.) Mr David Dick, gardener at Dalquharran to Mr Kennedy of Dunure, near Maybole, Ayrshire, recommends planting before the middle of April.

(5.) Mr Thomas Reid, farmer, Monkton Mill, Ayrshire, also recommends planting as early in April, as circumstances will admit.

(6.) Mr William Stent, nursery and seedsman, East Stockwith, near Gainsborough, Lincolnshire, recommends all potatoes to be planted by the last week in April, or, at the latest, by the first week in May.

(7.) Mr David Henning, Dunkeld, Perthshire, considers the late planting to be the chief of the three causes of failure which he mentions, since potatoes are often now not put into the ground until the beginning or even the middle of June, instead of the end of April, or the beginning of May, as formerly when there were no failures. He further states, that, under a low temperature and without any covering of mould, the potato will germinate spontaneously in March, or early in April, and that this, therefore, is the proper time for planting it. Accordingly, says he, there is not an instance of failure in gardens, in whatever way the potato has been planted; and there it is customary to plant early in April.

It is suggested by several, that, if the period of planting should be later than that which they recommend, the drill be made proportionally deeper.

We have thus, from seven individuals, in different parts of England and Scotland, the precept, given to their brethren in the same profession with themselves, to pay particular attention to *early planting*.

§ II. The period of *lifting*,—and whether the seed should be *ripe* or *unripe*.

(1.) Mr Crozer is of opinion that the seed should be unripe, and mentions a kind of potato, used by him and others, which, when planted ripe, was curled ; when unripe, seemed to escape the disease entirely.

(2.) Mr Reid, Bonshaw, near Stewarton, Ayrshire (in a communication addressed to the Secretary of the Ayrshire Agricultural Association) advises late planting and *early lifting* the potatoes which are intended for seed. He says, that, in 1834, he planted potatoes, and lifted the produce in two months, and sent them for trial to places where the dry rot had prevailed, and not one of them failed ; while others raised on the old system did so. Then, again, he says, “Plant those, which you intend for seed, on the richest soils ; *lift them while the juice is in them.*” (It would appear that this last circumstance is the essential one in his estimation.)

(3.) Mr R. Lymburn, Kilmarnock (also, in a communication of a very scientific and meritorious character, addressed to the secretary of the same association), shews on scientific principles that the potato plant germinates best when it is not fully ripe ; but that it is much more difficult to preserve it in a sound condition, and, therefore, that there is much danger in carrying the experiment too far.

(4.) Mr Dick at Dalquharran’s experience, concurs with the scientific reasoning of Mr Lymburn in the most minute manner.

(5.) Mr Stent, in his printed essay, says, that the potato can receive no benefit by remaining in the ground after the top is dead ; therefore, that we ought not to delay taking it

up, till too late in autumn. He mentions a very large crop which he obtained from potatoes planted on the 2d April, lifted on the 10th July, and then subjected to a treatment which is particularly described in his essay. This experience is so far in accordance with the advice of Mr Reid, (2.) that Mr Stent's potatoes were little more than two months in the ground.

(6.) Mr Henning, Dunkeld, very decidedly and strongly *differs* from the opinion, that unripe potatoes are best for seed. The risk of sweating, heating, or fermentation of the unripe plants, is mentioned by him as an additional reason for avoiding the practice of lifting and storing them when in an unripe state, and, in the reality of this danger, others agree with him; nor is it contended by any, that they shall be too unripe to keep. It is merely contended, that the juices ought still to be in the roots which you intend for seed, and that for this purpose these should be gathered, say a week or ten days, before the crop is thoroughly ripened.

§ III. The proper mode of *preserving* the potatoes intended for planting.

1. Mr Dick recommends the storing in narrow pits, or leaving ridges in the ground in a shady place during the winter, in order to prevent fermentation, which is likely to ensue if the potatoes are put together in too great numbers. Both plans have succeeded with him.

2. Mr Stent, in his printed essay, has a regular ventilating process, which is very deserving of attention; but perhaps a simpler method may be devised, if the importance of the effect produced, is duly appreciated.

3. Mr Henning also enforces the necessity of securing *coolness* in the pit, or place, where the potatoes are stored. He mentions a remarkable instance, by way of analogy, of barley which had been stacked in a dampish state, and had heated, but which was scarcely at all discoloured, and brought the market price at the time, but of which not the half grew. To

prevent this in potatoes, and in order to illustrate the reality of, and a probable remedy for the evil, he adduces an instance of a friend of his, who, by way of experiment, opened one end of the pit where his potatoes were stored, and left the other closed. Those potatoes, which were near the end where they were exposed, came up a good crop; those, towards the opposite end, were a failure, other circumstances being of course the same.

4. Mr Blacker (agent for the Earl of Gosford, in Ireland) is stated, (in an extract taken from the *Newry Telegraph* by the *Ayr Observer*,) to have recommended, at an agricultural meeting held on the Earl of Gosford's estate, the very plan which Mr Dick, gardener to Mr Kennedy, has successfully adopted for preserving the seed potato. Mr Blacker says, "Try the experiment of leaving a perch * or two of potatoes in the ground (it must be in a shady place), and see the effect, as compared with the produce of those which have been housed or pitted."

5. Mr Bruce, at the same meeting, said, "I have taken potatoes this season in June! which had been in the ground all winter, when they were four and five inches long, with green tops, and cut them, and none failed when they were planted in moist soil."

More evidence on this point might be adduced; but I content myself with these five advisers, as sufficient for recommending due attention to keeping the potatoes cool and moist during winter, and for suggesting a simple method of doing so.

§ IV. The next point of importance to be adverted to, is the *proper preparation of the ground*, when potatoes are intended to be planted; and *the importance of its being in a proper state, at the time they are planted, and afterwards*, as to mois-

* A perch is the 160th part of an English acre.

ture, freeness, or friableness ; and the best modes of remedying any risk of the reverse.

1. Mr Smythe, of Gibliston, near Colinsburgh, remarks: "The state of the ground as to moisture should be carefully attended to ; if in a wet condition, from previous or frequent falls of rain, it (the planting) had better be postponed. If in a dry, heated, and parched state, from previous winds, clear sunshine, or long continued drought, the planting should on no account be commenced. The happy medium between the two extremes is the most desirable, and should not be lost or trifled with for any other consideration."

2. Mr Crozer senior, of Newcastle-upon-Tyne, says, that, when April and May have been tolerably moist, he has uniformly observed, that there has been no failure of the potato ; but that, when they have been dry, with a good deal of sun and wind, it has failed. (This is the same gentleman who recommends *very early* planting, and who states, that, when the potato has been planted as early as from the first week in January to the middle of March, he never has known a plant fail. This is, however, quite consistent with the statement now quoted ; for such is not the general custom, and his recommendation is, therefore, justified by the risk, which later planting, in his view, and according to his experience, brings along with it.) Mr Crozer further states, that if the land is dry, it is of advantage to roll the land after the potatoes have been planted, for the purpose of exciting vegetation, of excluding the sun and air, and pressing the dung round the plants. Again, Mr Crozer mentions an instance of a failure of the plant in cloddy land, of success in fine and free land, in consequence of the sun and air having got in, other circumstances being the same ; and, in coincidence with this, he also refers to failures in raised drills, as contrasted with a good crop on flat ground, planted with the common spade.

Mr Crozer further states, from experience, the mischievous effect produced by exposure of seed or ground (as well as of

the dung, of which presently) to the sun's rays at the time of planting, and refers the failure of part of his crop, planted at mid-day, as contrasted with the success of another part planted during the moisture of the morning, to that specific cause.

3. Mr Maclintock, Hurlet Alum-works, agrees with Mr Crozer on the expediency of *rolling* the ground after the seed has been put in (while he condemns the process of *harrowing* at that time, approving of it when the plant is coming through the ground). He also deprecates the exposure of the seed to the rays of the sun.

4. Mr Rankine, gardener, Kilsyth, (a very distinct writer, and who has also published a judicious essay on the cause and remedy of *curl* in the potato, in the 3d Report of Drummond's Agricultural Museum at Stirling,) among other excellent advices, to be presently adverted to in their order, says, that the potato drills should be made up in the afternoon, when the damp is beginning to fall, and that planting in the heat of a mid-day sun should be avoided ; but that *in damp weather* this precaution is unnecessary.

5. Mr Robert Wilson, Drumbeg, Kirkoswald, Ayrshire, has the following judicious passage in an essay transmitted to the Secretary of the Agricultural Association for Ayrshire : " We should select such soils for potatoes as have the greatest power of absorbing and duly retaining moisture. I say *duly*, for I believe some are too retentive, not of moisture, but of liquid water. Hence, good loam, with a free subsoil, seems the most likely to succeed. But in the rotation of a farm this cannot be followed out ; and some farms have little or no soil of this description. In tenacious clays, every means should be employed for breaking down the hardened clods, reducing the soil to a powdered state, and bringing it to resemble, as much as possible, mechanically, a loamy surface. Should the weather be dry after planting, rollers should be passed over the field, for the purpose of consolidating the surface, lessening evapora-

tion, and retaining moisture." "Thorough draining," Mr Wilson continues, "will operate beneficially on the same principle. This may seem contradictory, that effective draining should be the means of supplying soils with moisture. But it is evident that stiff clay land, in continued drought, becomes so hard as to resemble brick, which is extremely difficult to pulverize. If not pulverized, but left in large clods, a greater evaporating surface is exposed, and its texture being more open, the cause of evaporation will penetrate deeper; besides, such soils have the radical defect of possessing less absorbent power than loam soils."

6. Mr Reid, Bonshaw, Stewarton, also recommends rolling dry soils.

7. Mr Dick, at Dalquharran, says, "Among the potatoes planted in May, it is a common occurrence this season (1836) to see few failures on the damp parts of the fields; while, on the dry rising grounds in them, the failure is nearly complete, though planted in the same *hour*, with the same quality of seed and manure.

8. Mr Lymburn, Kilmarnock, says, "It will be found that potatoes planted by the spade, and the ground well pulverized so as to retain damp better, and those planted in light friable soils of a damp nature, as most of our moor lands are, have had few or no failures. In seasons, when drought has the appearance of continuing, the ground should be well pulverized."

9. Mr George Woodburn, Ralston Hill, near Kilmarnock, (in an essay read before the Ayrshire Agricultural Association), says, "I have seen whole fields drilled before the planting was begun—a plan which I do not approve of, as the more moist the ground is, the better will be the braird."

10. Mr Stent, the Lincolnshire nurseryman, recommends immediate covering in, to prevent the soil becoming too dry, in case the weather is very fine, (that is, bright sun) at the time of planting.

11. Mr Rennox, steward to the Rev. Dr Blacker in Ireland, (according to an extract from the Newry Telegraph, above quoted), says, “ We had no failure in our potatoes this year, and we had about twelve acres set. But I think a great many people suffer injury by letting the seed lie too long on the ground before they cover it, exposing both to the heat of the sun and air.”

12. Mr Bruce, whose opinion has likewise been already quoted, says, “ I have found that all potatoes put into the ground the same day the drills were opened, and manure spread, and immediately covered up and rolled, were no failure; if delayed till next day in the afternoon, a complete failure. For experiment, *I dried twenty-four potato sets in the sunshine for nine days, until they were completely withered and soft. I then put twelve of them into new dug soil, and all turned out healthy plants. The other twelve I put into dry withered soil in the common way, and all failed. The sets were put in at the same time.* All ground for potatoes should be ploughed early in winter; and, again in March, it should be ploughed, harrowed, and cleaned of weeds, and laid down in a fine smooth state; and, if a drought commences in April, let a farmer plough as much every morning, as his help can finish that day while the soil is moist. Whenever the soil is much drier than the cut seed, the dry moulds suck the moisture from the seed sooner than the potatoes can vegetate, which causes the dry rot.”

I may just mention farther, that the Answers to the Queries circulated by the Society, are entirely corroborative of the mischievous effect of drought, whether of soil or weather, at the time of planting. Mr James Paterson sent to the Ayrshire Association, through Mr Johnstone, Redburne, factor to the Earl of Eglinton, Answers regarding the crops of the three years, 1834, 1835, and 1836, the results deducible from which appear to be as follows:—1st, That, where the land or weather was moist at the time of planting, no failures ensued, whether

the time of planting was the 4th April or the 7th June. 2d, That the failure was greatest where the ground was both dry and lumpy. And

Mr Johnstone himself says, "In any case that has come under my notice, I cannot say that a single failure has occurred, where the seed was unsuspected of taint, and the land dampish at the time of covering it in. I do not mean wet or soured land, but that occasioned by recent rain."

Mr Wilson, Drumbeg, Kirkoswald, Ayrshire, in answering the Queries, in like manner says, that the level ground, on which he had a partial failure, was very dry at the time of planting,—that there was no apparent moisture in the drills,—and that, the first twenty-two days after planting, there was dry weather, with high easterly winds.

Mr George M'Combie, Upper Braid, Mid-Lothian, also says, in reply to query 6, that the part of the potato field which was retentive and stiff was not thoroughly drained; and to Query 8, that the weather, subsequently to the planting of the potatoes, was dry; and that, at any rate, the rain which fell, did not go to the bottom of the furrow.

It does not appear to be necessary to enlarge farther on this part of the subject. I think there is a concurrence of about *fourteen* individuals belonging to various parts of the kingdom, who point out the mischiefs resulting from exposure of the soil to the rays of the sun while planting the potato, the importance of the ground being then in a moist state, and the proper methods, on the one hand, of securing this, or, on the other, of remedying, in so far as it can be done, the contrary state or tendency in the soil. Combining the notices given under this section, with those contained in Section I. especially, which inculcate early planting, and with what is yet to follow regarding the proper preparation and management of the dung, selection and treatment of the seed, I think it is not unlikely that the risk of failure will be greatly lessened.

§ V. *The Dung—Its best state for encouraging vegetation—The proper quantity to be used—How it may be prejudicial, and how it is best employed—How its beneficial properties are apt to be impaired—The kinds of dung which are thought preferable—Can it ever be dispensed with in the cultivation of the potato?—and when?* These several points will be respectively touched upon under the next head, according to the same method which has already been adopted.

1. Mr Smythe, of Gibliston, by Colinsburgh, says, that, notwithstanding of Sir Humphrey Davy's opinion, he considers old and well-rotted dung infinitely preferable for most crops, but especially for potatoes, to dung fresh and new from the straw-yards. "On large farms," he adds, "it may be convenient and desirable to have part of the ground manured with fresh dung; but, in such cases, this should be done, and ploughed in before winter, and an additional quantity must be allowed; but for the rest, it should be carried out at convenient times during the winter, deposited in large heaps, and, after heating (but not to the hurtful degree termed fire-fang), it should be turned over once or twice before being applied." As to the *quantity* of manure to be used, Mr Smyth observes: "Avoiding extremes, I should say, that from twelve to fifteen tons of good straw-yard dung, well prepared, for each imperial acre, would, under ordinary circumstances and seasons, yield a fair average, in many instances, a full good crop, leaving the land in good heart for the succeeding crops of wheat, barley, or oats, as may be deemed most advisable.

2. Mr Peter M'Gill, Secretary to the Kinross Agricultural Society, in a letter to Mr Gordon, the Society's Secretary, mentions two fields, which he calls No. 1. and No. 2. He says, that the dung for field No. 1. was driven out during the winter of 1835-6, and was rotted and short. The field was likewise all planted within three days or so of the same time; but it hap-

pened, that, before the planting of this field No. 1. was quite completed, the farmer took along with him, on two particular mornings, two cart-loads of *very long dung*, and this was applied by itself; in this part of the field there is an almost complete failure, whereas the whole of the rest of the field No. 1. has produced an excellent crop. In the field No. 2, rather more than an acre, being a considerably larger proportion of the field than in the instance of No. 1, was manured with long dung, and this too was a failure, whereas the rest of the field was a good crop.

Thus much in confirmation of Mr Smythe's opinion just quoted.

3. Mr M'Lintock enjoins carefully to avoid exposing the dung to the rays of the sun, since the best part of it is thereby carried off. He recommends in hot, dry seasons, to cover the dung well up in the drill, before dibbling in the seed.

4. Mr Wilson, Drumbeg, near Kirkoswald, Ayrshire, says, that his failure of potatoes was less this year, than in the years 1834 and 1835. In the year 1834, when it was greatest, he attributes it to the high state of fermentation in which the dung was. In 1835, the dung was less hot, and the failure was less. He has found, that, where the dung was quite cold, he had no failure. In each case, the other circumstances of management were the same.

5. Mr Reid, Bonshaw, near Stewarton, attributes the dry-rot (which he considers to have been the character of the late disease in the potato) to fermentation in the dung among other causes; to prevent which, he recommends to turn the dung-hill, to mix it with earth, and to plough in the dung before planting.

6. Mr Thomas Reid, Monkton-Miln, Ayrshire, also advises the manure being ploughed into the land, some time previous to planting the potato.

7. Mr Lymburn, Kilmarnock, recommends that the manure,

which is used, be well rotted. Unfermented dung, he adds, has a tendency to absorb moisture.

8. Mr Woodburn, Ralston Hill, near Kilmarnock, who says he has had forty years' experience, and never has experienced a failure of crop, recommends mixing horse-dung and cow-dung together, the one of which he states to be too hot, and the other too cold. He advises to drill half an acre, then to put in the dung, spreading it instantly, and at once to plant the seed.

9. Mr Henning, Dunkeld, says, "When the dung ferments in the drill, it expands and heaves up the earth; and, when the fermentation is finished, it subsides, and leaves the seed not in contact with the soil. Wherever fermentation in the drill has taken place, this, I have been informed by practical farmers, has been found, on examination, to be the case." An instance is mentioned by him in Dumfriesshire, where one-half of the potato field was remarkably good, while the other half had entirely failed, other circumstances being the same. But the part of the field, which succeeded, was manured with dung which had been carried out to the field during spring, and had been properly fermented; whereas, on the other part of the field, in which a failure took place, dung, fresh from the straw-yard, had been applied.

An instance of a good crop, without the use of any dung, is next referred to, as having occurred in Mid-Lothian. A field, which had formed part of Lord Morton's policy, and had lain long in grass, was in high condition. One crop of oats only had been taken from it, and it is doubtful if it ever grew a crop of potatoes before. It lay on a slope, and the drills ran from top to bottom. The lower and richer part of the field received no manure; the other portion of the same drills, and in the same field, were well dunged. The part, which was dunged, is a complete failure; the other part is an excellent crop.

There is still another instance, mentioned by this writer, (or

rather it should be termed an experience of fifteen years) on a farm in Galloway, in which it has been uniformly remarked, that the dung fresh from the straw-yard occasioned a less vigorous and a later crop than *a mixture of horse and cow-dung* (see Mr Woodburn's opinion) carried out in due time, and properly made. The injury to the farmer is still greater, if late planting and unfermented dung are combined, since the vegetation of the plant is at the very least retarded, and the crop is thus exposed to the risk of frost, before it has attained to maturity. Concerning the plan of mixing the manure with the soil, during the winter previous to the planting of the potato,—Mr Henning observes, that this will remedy the evil which would otherwise arise from unfermented dung; but, when the dung has been properly prepared, and the seed is good, and is put into the ground at an early period of the season, he considers the old practice, of planting on the dung put into the drill, to be decidedly the best, because it brings away the plant more early, and in a more vigorous state, than can be accomplished by any other method. But this writer farther states, that, whereas formerly a dry and rather high piece of ground was chosen as the stance of the dunghill, and whereas straw-yard sheds, where dung is now accumulated, were at that time used only on large farms, and even on such farms the dung was generally carried out from them during the frosts of winter; now, on the contrary, such sheds are almost universal, and, instead of carrying the dung to the field during winter, many farmers now keep their dung in sunken pits, by means of which the wash is retained in it. This practice is followed, from an idea that the evaporation of the nutritive gases is thereby prevented.

Since, then, such is the general practice, and such the prevailing sentiment among farmers, the practical result, of what this writer says, obviously is, that the dung remaining in this imperfectly prepared state, the proper way to use it, with a view to prevent injury to the potato plant, is precisely what

so many others advise, viz. to mix it with the soil during winter, if possible, or at any rate early in the spring, before the potato is planted, instead of laying the seed upon the moist dung, as has been frequently the custom hitherto.

10. An intelligent countryman belonging to Orkney, whose communication was forwarded to Mr Gordon by Mr Robert Nicolson senior, a gentleman of that island, observes, that the drier the dung is the better; that not above one-half the quantity usually given would be preferable; that dung is no improvement to the potato; that, when none is used, the potato is good and the crop is much surer; that horse-dung is to be preferred to cow-dung, but that straw is better than either. The most startling part of this statement, viz. that potatoes are better without manure, it will be remembered, is confirmed, in the instance of *Old Lea*, by what took place on the rich land lately ploughed in Lord Morton's park; and perhaps the same may apply to moss-land used for potatoes; beyond this I cannot think that it is accurate. The remainder of this humble, but intelligent, person's observations appears to deserve attention.

We have thus, in regard to the proper mode of using the dung, and in relation to the best condition for it to be in when used, seven or eight judicious advisers, who appear to be of one mind. 1. That well rotted or duly fermented dung is favourable to the vegetation of the potato seed. 2. That if the dung has not undergone this process of preparation before being put into the ground, it is of importance that it should be mixed with the soil during the winter previous to the planting of the potato, in order that the fermentation, and consequent absorbing of moisture in the soil, may proceed at a season when the supply of moisture is abundant, and that the seed may not be exposed to the weakening influence to which such action would subject it. But, 3. It still appears quite consistently to be thought by some, that, if the dung *has* been thoroughly rotted, and if the fermentation has thus entirely

ceased, no injury, but considerable benefit, may accrue from laying the seed upon the dung, as was formerly done, when, according to the testimony of several of the writers, the dung used to be in this thoroughly prepared state. 4. It is not necessary to do more than to advert to what is stated, by two of the writers, of the advantage of mixing horse and cow dung, experienced by them and others; to the discretion, as to the quantity of dung, which is requisite; and to the few cases, in which dung may be dispensed with, in cultivating the potato, without injury, either to the land, or to the crop.

§ VI. I now proceed to refer to a very important part of the subject, viz. *the seed-potato itself*, and to inquire of our essayists, *from what localities it ought to be procured, and whether it should be planted entire, or in cuttings?*

1. Mr Smythe, of Gibliston, near Colinsburgh, finds the seed which he imports from high, late, and cold-bottomed land, grow best; he is in the habit of changing his seed to a certain extent every year.

2. Mr David Inches, Cardean, Perthshire, says, in writing to Mr Charles Gordon, "For upwards of forty years, I have grown potatoes, to the extent of from fifteen to thirty Scots acres each year, and have never *until this year* failed in raising fine crops without a single exception. My practice has been, to bring the seed from a higher climate every *second year*." (He mentions that his dung was in a very *moist* state this year, and that in no one instance did the dung remain uncovered *half an hour* after being laid, before the whole operations were completed.) His seed, which failed this year, looked better than that which succeeded; that which failed, was imported last year; that which has succeeded, was brought from a distance this year. Mr Inches further mentions, that he intends for the future to plant *whole* potatoes in three feet drills, and fourteen or fifteen inches betwixt the plants. "*This*," says he, "*I did some years since, and found that the additional*

expense of seed was fully made up by an additional crop grown." He is very desirous that the Society should declare its approbation of the practice, and believes that, in doing so, it would confer a boon on the country. In a postscript, Mr Inches states, that he has examined some fields where whole potatoes were planted this year, and all these are doing well ; but in two of the fields, where part of the seed was cut, there has been a failure.

3. Mr Rankine, gardener, Kilsyth, says, that "those potatoes which have been for several years planted on much wrought ground, became diseased, and are affected by *the curl* ; and, being so diseased, are much more easily acted upon by those causes which induce the more formidable and fatal disease of *the rot* than others which are planted in a healthy state. Some kinds also are more easily affected by these causes than others. The *red* potato, for instance, *when it has been cut*, and planted when the ground was in a very dry state, and when its planting has been succeeded by a long drought, such as we have experienced these few years bygone, loses its sap by evaporation ; the nutritive particles get into the starchy state, the fermenting qualities are destroyed by the drought, and, whenever rain comes, the set rots, and is decomposed. *In all the examinations I have made, I never found a whole or un-cut potato die of the rot* ; and, when cut, it is more apt to be affected in the manner I have described, *if it has been cut for some days previous to the time of planting.*" Mr Rankine farther says, that, besides the reds, the *dons* or *pink eyes* are also more liable to dry-rot than others ; this he states from experience in his own grounds. "Again," says Mr Rankine, "I have examined many of the *cuts* or *sets* which were rotten, and have very frequently found that those, which had the cut side undermost, were the readiest to die with this disease ; for, having nothing but dry earth above them, and hanging as it were in the air" (see the passage quoted under the former section from the essay by Mr Henning), "they dry up,

decay, and die." Mr Rankine accordingly recommends the potato-set (if a set is used) to be put into the drill with the uncut side below, and before the dung is put in; or if the dung be first put in, he advises the set to be pressed down through it. "Persons," adds Mr Rankine, "when selecting seed, should be at the trouble to go in the month of July, which is the proper time for selecting it, to moorish, high-lying, and retentive tracts of the country, where the plough has been used more sparingly than in the more fertile parts, and see the potatoes growing, in order to judge which to prefer."

4. A valuable extract from the first edition of the Statistical Account of Scotland, has been sent to the Secretary of the Society, by Mr A. H. Simpson of Paisley; and this extract, while it affords excellent confirmation to the views of Mr Rankine, is very deserving likewise of general attention now. It is taken from the account of the parish of Hamilton, which was written by Mr John Naismith, author of "Thoughts on various Subjects of Industry pursued after in Scotland," and the extract more particularly relates to the disease of curl, which he states to have made its first appearance about the year 1770 or 1771, in rich low-lying ground, manured with offals from that town. The following are the words of the concluding paragraph of the extract:—"Though the disease has spread much since its first appearance, it has been confined to low-lying lands, and has not yet (1792) reached any place in this part of the country, which lies more than 350 feet above the level of the sea, nor are plants, sprung from potatoes, which grow in such places, subject to it, even in the low ground, for a year or two. *Since this has been discovered, it has proved the best antidote against the growing evil.*" Mr Rankine advises the use of a similar remedy, for the disease now prevalent.

5. A communication, addressed to Mr Norman Lockhart, from Lanark, here deserves insertion, principally as illustrating the different results of planting the potato, *entire* or *cut*,

under circumstances, which, from the tenor of the preceding part of this report, will be seen to have been somewhat unfavourable to the germination of the crop. The field in question had been cropped for the five years ending with the season 1836, as follows :—Crop 1832, potatoes ; 1833, barley, sown down with red clover, but no grass seed ; 1834 and 1835, cut clover ; 1836, potatoes. The ground, (an English acre or thereby,) had received twenty-four yards of horse-dung, mixed with ashes and pig-dung ; it was spread about the 1st May, and the ground was then neatly dug with the spade. The potatoes were planted about *the 16th May* with a foot dibble. *About one-half of the land was planted with cut potatoes, the other half with whole potatoes ; only a few of the cut potatoes have brairded, and those that have come up are of a sickly appearance ; the potatoes that were planted whole have all come up, and the braird is of a healthy appearance.* The potatoes, from which the field was planted, were of both *the red and white* or early kinds ; some of the red kind were brought from Dumfriesshire in 1834, and some of them were got a few miles up Clyde, the same year ; last year, both were planted here, lifted dry, and well kept. On *the 16th June* (that is, just one month after planting) *the field was very minutely inspected, and many of the plants, both of the cut and whole potatoes, were dug up, with a small spade, when the following appearances were uniformly presented, viz. The cut potatoes, both those that had come partially up, and those that were rotten, were all found to have been in a greater or lesser degree attacked by a large grub, of which grubs from two to eight were near each cut seed ; the attack seemed to have been uniformly made upon the cut part of the seed ; in no instance was the skin found broken ; the potatoes, that had been planted whole, were uniformly found unattacked and quite fresh.* Precisely the same appearance was observed by this gentleman *on the cut side of the turnip seed.*

6. Mr Wilson, Drumbeg, near Kirkoswald, Ayrshire, while

he mentions, in his Answers to the Society's Queries, that he used for seed the *cuttings* of potatoes; that he placed them *indifferently*, with the cut side, or the uncut, next the manure; and farther (as referred to under the last section), that in the three years, 1834, 1835, and 1836, his failure was progressively less and less, according as the dung was progressively less and less hot, to which circumstance he attributes the different results, makes this important observation—"Whatever abstracts moisture rapidly, whether it be in the air or the manure, seems to do harm, and, therefore, every method of counteracting such influence, should be adopted. Such agents, *by dissipating the juice of the potato*, appear to lessen or destroy its living power. *Probably if the potato were planted entire*, it would be less liable to such accidents; *the epidemics would tend to the retention of its juices, and defend it from dissipating agents without.*"

7. Mr Alexander Reid, Bonshaw, near Stewarton, Ayrshire, also recommends planting *whole* potatoes; or, if this is not done, that the sets be planted "below the dung and deep, to save them from the heat near the surface, that may be occasioned after rain, when the ground has been very dry, or by the fire in the air, meeting with that in the earth in dry soils. "Damp soils," he says, "on the other hand, just require the reverse, to protect the seed from the wet rot."

8. Mr Robert Gray, farmer, High Doun, near Girvan, Ayrshire, says, "The taint made its first appearance in this quarter in 1834, and since that time it has been increasing rapidly. The progress of the seed towards decay has been pretty uniform, from a fortnight to three weeks. From the time of planting, putrefaction may be seen to have commenced on the *cut* surface of the seed, and in about eight days or more, it will be one mass of rottenness. The young shoots, however, will be coming away in the mean time, and, *when the circumstances are favourable to its growth*, may have attained a strength sufficient to render it independent of the decayed

seed. I may mention, in conclusion, that the only way of remedying the evil appears to me to be, *planting the potato entire*. This is the plan I intend following myself, and I do not hesitate to recommend it to every person who has potatoes to plant." Mr Gray also says, "The cups (speaking of his own crop) whether planted whole or in cuttings, produced an excellent crop. The red ones, when planted whole, also produced a good crop; but, when cut, though the circumstances were in other respects the same, they were nearly a total failure.

Speaking of six acres planted by him for the people of Girvan, they furnishing the manure, seed, &c. which was of various kinds, Mr Gray says, "Where dry ashes were used, the failure was complete, without a single exception; it was much the same with seaware, *except in one instance, where the seed had been planted entire*. With respect to the seed, I believe every variety grown in the neighbourhood was used, Scotch Brown, Fancies, Moravians, Dons, Seedlings, and Cups; of these the Browns were the first to give way, and the Cups the last."

9. From Mr James Paterson's Answers to the Queries, the following inferences are deducible, regarding the crops 1834, 1835, 1836, in addition to those already noticed. 1. That, even when both the land and the weather were dry, *the entire seed being planted*, and having been brought from moss-land, a fair crop came up. 2. But that, in no one instance, did the *cut* seed, *although brought from moss-land*, withstand the united unfavourable impressions of dry lumpy land, dry weather, and level ground. The only difference, in short, between the circumstances of the entire seed which came up, and the cut seed which failed, appears to have been, that the uncut was planted on an acclivity, the cut on level ground. It does not, however, appear that much stress ought to be laid upon this difference; nor that, if the seed had been entire, any failure on the level ground would have ensued, especially when we re-

member the success of *entire seed*, with *seaware* as a manure, in the case of Mr Gray, last adverted to.

10. Mr Thomas Reid, Monkton Miln, Ayrshire, says, "Although, *by changing the seed*, I can still grow an average crop of potatoes, yet, when raised, almost one-half of them are affected with a disease that renders them unfit for use. This disease is called *the black* or *dry rot*, and has been long known in this neighbourhood, but its effects are becoming more generally felt over the country, as it is now observed on many farms where it was never known before, and every succeeding season the potatoes are grown on the same land, they shew more of the disease. Instead of potatoes, I now grow turnips, but in the Swedish I have for several years observed the same or a similar disease." (Compare this with the account transmitted to Mr Norman Lockhart from Lanark ; it is evident, from what immediately follows, that it is the *cut* potato and turnip seed which is here meant.) Mr Reid recommends, as a preventive to this disease, *to place the potatoes in the earth in their natural or uncut state* ; in this way, the exciting parts of the manure have less effect upon the seed, and the moisture would be better retained in the earth. It may also be observed, adds this writer, that when the seed has been allowed to grow, and has been several times picked before planting, its vegetative powers are thereby much weakened.

11. Mr Lymburn, Kilmarnock, says, that if cut tubers are preferred, they ought to be well sprinkled with lime and water, when drought has the appearance of continuing. (Mr Crozer thinks pure water as good, because the moisture is all that is wanted.) Mr Lymburn goes on, "*whole potatoes resist drought better*," but they send up, he thinks, too many stems, and the potatoes are apt to be smaller in size. *In ordinary seasons*, he is of opinion that cuts or sets from vigorous tubers do best ; a similar opinion is given by Mr Thurnson, one of the gardeners of the Horticultural Society of London,

in a communication to that Society, read at a recent meeting by Dr Lindley, the secretary, in which he states, that the points of the tubers had been found to be *more* productive than the whole root. But I must observe, that, as there is no security for what are called *ordinary* seasons ; and, as all authorities are agreed, that there is no ascertaining by the appearance of the seed before planting, whether it is vigorous or not ; it is better to adopt the precaution, which none have known to fail, for guarding against injury from drought and disease in the plant, *the absence of which are admitted to be essential to the vegetation of the cut tuber.*

12. Mr George Woodburn, Ralston Hill, near Kilmarnock, says, “ If the seed be planted in low land, it should be brought from moor or high land, and laid in a damp place, sheltered from sun or wind. I seldom commence cutting the seed, until I am ready to plant it. I think attention in preparing seed, making the cuts rather large than otherwise, and mostly from the top end of the potato, of considerable advantage. Indeed, *I am of opinion that some of the potatoes should not be cut at all.* The ground should be changed as well as the seed. I know land which has been cropped with potatoes every third or fourth year, for at least thirty years. Such a practice is reprehensible, and, unless abandoned, I am afraid the farmer may lay his account with a continual failure of his potato crop.”

13. Captain Alexander Montgomerie, R. N. Brigend, near Largs, Ayrshire, coated his cut potatoes with lime and water, of the consistency of white wash ; and out of two drills, one in each of two fields, only two plants failed in the one drill, and in the other only one plant failed ; whereas the same seed, planted in the usual way, failed on either side of these drills to a great extent. Captain Montgomerie believes that the failure of the three plants was occasioned by the sets having adhered together, so as to prevent their being thoroughly coated (care must be taken not to make the lime and water too thick). He has no doubt that *whole potatoes* will be

equally efficacious; and he adds that *he has heard of no failures where they have been used as seed.*

14. Mr Blacker, agent for the Earl of Gosford in Ireland, says, “I think it worth mentioning that I have heard from several, that *if the seed is cut and left for a few days*, there will appear a speck or blackish spot in the heart of those which will not grow, being the first symptoms of decay; this is I think fully acknowledged.” Mr Blacker also refers to “the general opinion that *whole potatoes are more certain than cuttings.*”

The fourteen writers now quoted, do not appear to disagree materially, and their instructions require no additional enforcement: 1. The entire potato has not been known to fail. 2. The cut potato, exposed or planted, is frequently known to rot and become useless within a very few weeks. 3. No sure judgment can be formed by the previous appearance of the set, whether this is to happen or not. 4. Lime and water sufficiently applied to the cut side, has a tendency to prevent the rot. 5. The disease has spread greatly, and has been observed to affect the cut side of the turnip-seed, as well as that of the potato—one writer says, of the Swedish turnip; the other who mentions it, does not specify the kind. 6. Another important precept is, to bring the seed from high moorlands; and it even seems desirable to do so every year, if the situation where it is to be planted is low, and the land has been long under crop. 7. A frequent change of land for the growth of potatoes is likewise inculcated.

§ VII. There remains just one other matter to be adverted to before bringing this report to a conclusion, viz. the question *whether the plant be weakened or worn out*, and whether it is expedient to cultivate it more by means of the *apple*, and less from the root, than has of late been in use to be done.

1. Mr James Carse, Dalrymple, Ayrshire, who addresses to the Editor of the *Ayr Observer* (published on Tuesday the 29th November 1836) a long and very intelligent letter re-

lative to this subject, expresses therein an opinion "that potatoes have suffered diminution to a great extent in their organic and vital qualities;" and adds, "we may suppose that the same degree of heat, that will not injure strong and healthy potatoes, will completely destroy the vegetative power of those that are weak and feeble; in which last state, I consider the greater proportion of the potatoes in this country to be in at present." Again, he says, "from the now weak and feeble state of potatoes, they are not able to undergo the same treatment they did formerly. For, since I can recollect, supposing the *cut sets* had been exposed to heat and drought till they were shrunk and shrivelled like a dried pickled oyster, they would have vegetated quite vigorously when committed to the ground." * Mr Carse attributes "the primary cause" of the deterioration in the organic or vital principle of the potato, "to the operation of the dissecting knife."

2. In the extract from the former edition of the *Statistical Account of Scotland*, already referred to, this appropriate paragraph also occurs (various speculations it would appear were then brought forward regarding the cause of the disease of *curl*, as now regarding that of dry rot, and Mr Naismith, the author of the report of Hamilton parish, observes in relation to one of these):—"The most popular and plausible" of the causes assigned, "is, that the root degenerates, by being too long planted in a country, widely different from its native soil and climate; and that, to prevent this evil, it ought to be renovated by obtaining new ones from the seed contained in the apple. But, waiving all speculative reasoning on the subject, one plain fact is a sufficient objection to that hypothesis; namely, that *the disease never made its appearance till after those renovated potatoes were introduced, and has increased as they have been multiplied.* It must, nevertheless, be acknowledged that raising new potatoes from

* See page 486, where an experiment is mentioned, shewing that this might still happen, if the ground were only moist enough, when the sets were planted, after such treatment.

the apple for seed has been of considerable service. *They become fit to be discriminated, and cut into sets for seeds the second year; and, when proper kinds are chosen, and the other varieties with which they are always accompanied, rejected, they generally prove very fruitful for some years.*" Just one other short sentence from this writer, and I proceed to another; he says, regarding the *curl*, "when the disease once appears among potatoes, if part of their produce is used for seed, in the subsequent season, a greater proportion of the potatoes will be infected every year, *though those sprung from diseased plants have been rejected.*" Now, without pronouncing, that a similar result will accrue, in regard to the seeds taken from a crop which the *dry rot* has infected, the hint appears to be sufficient to induce caution, and forms a strong additional motive for paying attention to the precept, given under a former section of this report, *to change the seed every year, and to bring it from localities where the disease has not yet appeared*, and where, for the reasons there mentioned, it is not likely to occur.

3. Keeping in view the terms of the former passage now quoted from this writer of 1792, I proceed to advert to what is said by "A Dumbartonshire Farmer," who says that he was "led to the conclusion, that the potato was exhausted by over-cropping, and that *the only mode to obtain its regeneration was to resort to the original seed in the plum.*" He adds, "A series of experiments, which I have since made, has fully demonstrated the truth of my conjectures. The vigorous stem, expanded deep-green leaf, and, above all, plants that were only three years from the seed last year, loaded with the plums, testify that all is again right, &c. The kind of potato, which first induced him to think of trying various methods of renovation, by a remarkable change in its appearance and quality, and which, from having been "very dry and excellent in quality, became soft, watery, and unfit for use, *was the kidney.*"

4. In allusion to this opinion and experience, Mr William

Young, late provost of Castle-Douglas, says :—" In four instances here, where the experiment of renewal from the plum has been tried,—one is said to have succeeded, the other three are complete failures. With regard to the potato-plum, I had in my field, two years ago, the greatest quantity of plums that were ever observed by people upwards of eighty years of age ; *yet the plants from these potatoes in the following year entirely failed.* The only potato, that has resisted the disease in this country, is a potato that never has a plum ; it appears to form a flower, but *that* never expands ; the produce is great, and it may be classed as a second early. It is a rough, round, white potato, exceedingly white when boiled, and possesses a more than usual quantity of farinaceous matter."

5. Mr Thomas Bishop, land-steward, at Methven, Perthshire, says : " In Fife, Angus, and Perthshire, where the red potato has been cultivated for about thirty years, many circumstances *connected with that variety* induce me to believe, that the partial failures, *which appear to be yearly extending* (see what Mr Naismith says *), are attributable to the want of vitality arising from its age, as the same plant has been continued from one year to another *by extension only*, without the renewal of its vital energies from seed ; and, perhaps, the failure of other varieties, in different parts of the country, will be found to proceed from a similar cause, as I am aware that many of them *have had the same treatment*, and been in cultivation for an equal length of time. I am far from asserting that many of the alleged causes, which have been promulgated by different writers as the occasion of this widely-extended malady, may not have accelerated the debility of *an aged decaying variety.*" Again, " Those who recollect the strong and vigorous stems, perfect flowers, and abundant crop of seed-plums, which the *red* potato exhibited for a number of years after its introduction to Perthshire, compared with the puny, slippery stems, and abortive organization of flowers,

now visible in that variety, must be convinced that this variety is strongly deteriorated, and that it is only by procuring *new* and *valuable* varieties from seed that the productiveness of the potato crop can be ensured, and restored to its former worth." Mr Bishop has himself made the experiment on this variety, following the plan of *careful selection* recommended by Mr Naismith, and throwing away, accordingly, a great many. Those which he selected he states to have done exceedingly well. (I regret being obliged to omit any part of Mr Bishop's communication.) *

6. Mr Carnaby, writer, Forfar, has made a successful experiment in propagating from the seed, but the kind of potato is not mentioned by him.

7. Mr Wilson, Drumbeg, recommends immediate resort to the seed, and to choose such varieties as are distinguished by density of structure, abundance of juices, and, consequently, superior weight. He says that the kind called the *cup* "has not only not failed to grow, but has grown vigorously *in all soils, and under all circumstances*;" and he adds, that this kind shews "marks of much strength *in structure*, as well as in growth." (Is it possible that it may be the *texture* rather than the *age* of the variety which renders it safe or unsafe "*to cut*" in trying seasons, and therefore justifiable, or the reverse, so to plant it in a dry season, since the danger of propagating a destructive disease is thus incurred?)

8. Mr Reid, Bonshaw, near Stewarton, Ayrshire, says, "To extirpate the disease, go to the original kind of potato, that, if I am not mistaken, rise spontaneously from subsoils, where I believe thousands of them may be found in places even in Ayrshire, where neither potato, nor potato-apple seed, has been planted in the remembrance of man. Botanists have found new plants in this way; and, to attract their attention to this useful root (as a member of the Ayrshire Agricultural Asso-

* See what Mr Rankine says of the effect produced by planting this very variety whole instead of in cuttings, p. 494.

ciation), I would propose to offer a premium to those, who should collect the greatest variety from any subsoil, or other subterraneous strata. I can shew different kinds which have been got in this manner."

9. Mr David Dick, gardener at Dalquharran to Mr Kennedy of Dunure, says: "I own I cannot discover the slightest ground, from any thing I have learned of the potato, to say that it has *any tendency* to become worse under ordinary culture in this climate;" and, in order to shew that injurious keeping will destroy potatoes but lately from the plum, as well as older potatoes, he has the following passage:—"Some potatoes, of large and good appearance, *the fourth year from the plum*, were cut, and a few drills of them planted *in separate fields, in May*, and *in both fields* they turned out almost a complete failure; while *a few of them, planted in a garden, early in April*, had few failures. (These potatoes, both those which grew well, and those which failed, had been stored in *large pits* along with some others.) "Another quantity of potatoes, the third year from the plum (but which had been stored in a *small pit* by themselves), were planted on the same day, with the same quality of manure, and in the drills that lay next to those above mentioned which failed, and these have grown very luxuriantly."

10. Mr Lymburn, Kilmarnock, observes: "The renewal of potatoes from the seed should be more looked after. Having had a good deal of practice in rearing and seeing reared, flowers from seeds, especially the ranunculus, I have invariably found that those most recently from the seed had so much more vigorous growth, both in the foliage and flowers, that it has become customary for florists to point them out, in each other's flower-beds, from their appearance. In the raising of new gooseberries from seed also, it is invariably found impossible, in subsequent years, to produce the fruit of a weight equal to what it has attained on being first shewn; and *I have no doubt that potatoes will conform to the same rule,*

and that those newly raised from seed will be found to possess more vigour of growth than after they have been planted for a long succession of years. The seed should be taken from the most approved sorts at present in cultivation ; and where different properties, as yet peculiar only to different sorts, are wished to be united in one, they may be blended by hybridizing the flowers, in the manner so ingeniously exhibited lately in fruits, by the Preses of the London Horticultural Society." Now, it is important to observe, that all this is speculation, not experience, but it is, like the rest of this gentleman's essay, remarkable for originality and intelligence.

11. Captain Alexander Montgomerie, R.N. planted this year potato seed, which, he was informed by the person who sold it to him, was only eight years from the plum, and had as great a failure as in any other instance throughout his crop.

12. Now comes, the very remarkable statement of Sir Alexander Charles Maitland Gibson, of Cliftonhall, Bart. (a proprietor in the county of Edinburgh, and one who has grown old in the business of practical farming) ; he states, that "the only kind of potato planted by" him "which were quite perfect, a healthy and productive crop, have been planted by" himself "for forty-eight or fifty years, and for seventeen years by his predecessors, (but) say sixty years, without any change whatever, either in management or ground ; *they have never been seeded, but merely cut in the common way.* The crop, of this kind, of this year, is uncommonly fine. They are called an Early garden potato ; they had always been kept separate from all other kinds, by being locked up in the wine-cellar. *I continued the custom, more especially from hearing it so generally asserted that they could not be continued long in cultivation without degenerating.*" Sir Alexander farther states, that in 1834, he planted in part of his land (which he describes as fine potato land, partly sloping to the south), a new *Russian potato*, of a dark purple colour, which looked very hardy, and

which he had only planted one year before : this *was a total failure.*

13. Mr Pollexfen, a gentleman of Orkney, addresses a communication to Mr Charles Lawson, the Society's seedsman, to the effect that, having had occasion twelve years ago, when the potato crop was broken over in Orkney with a gale of wind, to observe tubers grow on the part above where the fracture had been made, of a dark purple colour, and from the size of a hazel-nut to that of a walnut, he directed a parcel of the largest and best of these to be preserved in a dry place, and planted *whole* next season. " These began to sprout before other potatoes, previous to being planted, and they were the first up in the field, though planted at the same time, and subsequently treated in every respect as the rest. The produce, though not so large (individually) as the others, was more numerous, and the quality good." *Since this time he has cultivated them in cuttings, and has had no failure, nor have others who got the seed from him, although the drills on each side, planted with other potatoes, have failed,—*in different parts of the country and in different soils. The people about Kirkwall are following his example. The way to obtain these tubers, he says, is *to break over the stems of the shaws just above ground previous to flowering ; in this way you are sure to obtain potatoes of precisely the same kind as that from which the stem was produced ;* whereas, by means of the apple, you have *an endless variety, many of which are of very little value,* besides the time which is consumed in raising them. (This last remark is an excellent confirmation of Mr Naismith's opinion above expressed, in the extract from the Statistical Account of Scotland.)* Mr Pollexfen considers, that the *dry rot* is first originated by the great quantities of *crude* manure, used year after year by farmers for the purpose of procuring larger crops. Thus they are in a manner forced, as if in a hot-bed, and are rendered hollow in the heart ; it is there, accordingly, that the *dry rot* com-

mences, and, like that in timber, will soon communicate the infection to the whole tuber, *if not to others in its neighbourhood*. The Society owes its acknowledgments to this gentleman for his interesting communication, although it is not believed that the *fact*, mentioned by him, is of the nature of a *discovery*. The name of Captain G. W. Henry Knight, R. N. Inspector-General of the Coast Guard for Scotland, is mentioned, and he is stated to have seen and admired this gentleman's potato field, and to have resolved to adopt a similar method on his return to Perthshire. Mr Pollexfen says, *there was not a single plant wanting in upwards of three acres of potatoes this year!*

In summing up the results of the opinions given by the previous twelve writers, we find considerable difference of sentiment regarding the fact of deterioration, and still greater regarding the safety or expediency of employing the remedy of renewing from the apple. Three among them seem to say there has been a general deterioration; one confines the failure to the Perthshire reds; another, while he speaks of a general failure, excepts peremptorily the kind called *cups*; while two very experienced persons are as decidedly opposed to the idea of there being *any tendency* in the potato to wear out with ordinary treatment, and one of these presents us with an instance of a potato constantly planted and replanted in his own ground for sixty-five years, and this the only kind which did not fail him during the recent years of failure; another again says, that the theory of deterioration was broached previous to 1792, at the time when the *curl* was as prevalent as the *dry-rot* now is, whereas he never heard of the *curl*, until the remedy now proposed of cultivating from the apple was adopted, and these, incautiously selected, were, he believes, the real cause of the introduction of curl; four recommend a careful selection of the apples; one, to go to the original of the potato to be found in subsoils; three have found a careful selection of the apples succeed; three have found potatoes recently from the apple fail. What deduction

can be drawn from such conflicting testimony? Why, truly,—*caution* in the use of a doubtful remedy, which requires much skill, in order not to aggravate the evil; and perhaps it may be added, that it may be worth while to give a fair trial to some of the other sanative and preventive methods which have been suggested in previous sections of this report, before resorting to what may be considered an extreme remedy.

The method practised by Mr Pollexfen needs not to be here repeated; but it too would seem to deserve a priority of experiments, as being simpler, safer, and quite as effectual, as renewal from the seed. In the mean time, the fact of deterioration seems not to be by any means conclusively ascertained. Before bringing this prolonged report to a conclusion, I have to advert to some information regarding the uses to which *frosted* or *spoiled* potatoes may be applied, which it may be useful to make generally known.

It is stated by a writer in the *Greenock Advertiser*, that “though the potato may be changed by frost, its nutriment is not thereby destroyed. But the potato which has been the most injured from this cause, may very readily be made into flour or starch, by mashing and frequent ablutions with cold water. Thus a dish of “champt potatoes” may be made from potatoes nominally spoiled, by boiling them well and mashing them to pulp along with a little milk.

In accordance with this statement, *Mr Home Monro Binning* has made a communication to Mr Gordon, Secretary of the Society, to the following effect:—“I send a packet containing potato flour, forty-two years old, made originally from spoilt potatoes; it was given me by the lady under whose auspices it was made; I can therefore vouch for its being genuine. In the year 1794, a potato field at Camstradden, on the banks of Loch Lomond,” was flooded by the lake; “on the subsiding of the waters, the potatoes were dug up, and found to be rotten. They were put into tubs, and mashed in water, when the usual quantity of farinaceous deposit was

found at the bottom, the rotten fibrous part floating on the surface. On being used, the flour so made was found perfectly wholesome, and as good as any made from fresh, sound potatoes." Mr Binning believes that "it is not generally known as yet, that the process of making potato flour is in truth merely rotting the fibrous matter by means of the action of water, and so separating it from the farinaceous or nutritive part of the potato;" in short, just adopting the process recommended by the writer in the *Greenock Advertiser*. It is highly probable that the potatoes at Camstradden were frosted, as well as soaked by the water; but, whether or not, it is obvious that the submersion which they had undergone, was just the incipient process of the manufacture of potato flour. "Though not fit for food," adds Mr Binning, "such farinaceous matter might still be advantageously used as a substitute for starch made from wheat, and used for stiffening in the manufactories" or otherwise.

All which is respectfully reported to the Directors of the
Highland and Agricultural Society of Scotland, by
their obedient servant,

CHARLES FERGUSSON.

EDINBURGH, *January 23. 1837.*

Queries circulated by the Highland and Agricultural Society of Scotland, in consequence of which the information in the preceding paper was received.

IN order more satisfactorily to ascertain the causes of the partial failures in the Potato Crop during the present and late years, the Directors of the Highland and Agricultural Society of Scotland request that Farmers will favour them with Answers to the following Queries, on or before the 1st of December next, addressed to the Secretary, at the Society's Hall, Edinburgh:—

1. At what date were your potatoes planted ?
2. Were they planted entire or in cuttings ? If in cuttings, were these the half or the fourth ? and were they planted with the skin or entire side next to the manure ?
3. How long were the potatoes cut previously to being planted, and how or where were they kept after being cut ?
4. Did you select the rose-end of the potatoes for your seed, or were the cuttings of either end planted indifferently ?
5. What is the nature of the Soil on which your potatoes were planted ?
6. Has that soil been drained thoroughly, or was it unnecessary in consequence of its being naturally dry ; and what was its state in respect to moisture or dryness when the potatoes were planted ?
7. What was the exposure of your Field, and was it level or on an acclivity ; if on an acclivity, did the failure occur more in one part of the field than in another ?
8. What was the kind of weather during the month or six weeks immediately subsequent to the planting of your potatoes ?
9. What description of Dung or Manure was used by you for your potatoes in whole or in part ; and was there any difference in its state, or was it procured from different persons ?
10. From whence did you obtain your Seed, in whole or in part, and in what manner was it kept during the winter, and what was its condition when your potatoes were planted ?
11. What kind of potato was it ?
12. After what crop in the rotation were your potatoes planted ?

CHARLES GORDON, *Secretary.*

SOCIETY'S HALL, ALBYN PLACE,
EDINBURGH, 1st July 1836.

LIST OF MEMBERS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

AT 31ST JANUARY 1837.

ALPHABETICALLY ARRANGED, AND DISTINGUISHING THE YEAR OF
THEIR ADMISSION.

PRESIDENT,
HIS GRACE GEORGE GRANVILLE, DUKE OF SUTHERLAND.

The Members marked thus *, have been Presidents ; and thus † Vice-Presidents.
Those with § prefixed to their names are the only *original* constituent Members of the Society now surviving.

New Members are admitted at the General Meetings of the Society by Ballot. There are two such meetings annually, viz. the Anniversary Meeting, on the second Tuesday of January, and the Summer General Meeting, on such day in June or July as may be fixed by the Directors, and intimated in terms of the Charter. Members pay an Annual Contribution of L.1 : 3 : 6; or in their option, and in full of all future claims, a Life Subscription of Twelve Guineas.

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THE MOST NOBLE JOHN, MARQUIS OF BUTE.

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MR CHARLES LAWSON, *Nursery and Seedsman, and Curator of Plants and Seeds*.

MR JAMES SLIGHT, *Curator of the Museum of Models*.

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ACCORDING TO PRIORITY IN DATE OF ELECTION.

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James Hunt, Esq. of Pittencrief & Logie.

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Regulations for General Shows of Live Stock.—G. Macmiken Torrance, Esq. of Kilsaintninian.

The Argyll Naval Fund.—P. Small Keir, Esq. of Kinmonth.

LIST OF MEMBERS.

A		Admitted
	* ARGYLL, His Grace George William, Duke of	1790
	† AILSA, The Most Noble Archibald, Marquis of, K. T.	1793
	ABERCORN, The Most Noble James, Marquis of	1833
	† AIRLIE, The Right Hon. David, Earl of	1819
	ABOYNE, The Right Hon. Charles, Earl of	1819
	ABERDEEN, The Right Hon. George, Earl of, K. T.	1805
	† ARBUTHNOTT, The Right Hon. John, Viscount of	1803
	† ABERCROMBY, The Right Hon. George, Lord	1799
	ADAM, The Right Hon. William, Lord Chief-Com- missioner	1816
10	ARBUTHNOTT, Lieut.-General the Honourable Hugh, M.P. for Kincardineshire	1811
	ARBUTHNOTT, the Hon. John	1833
	ABERCROMBY, the Hon. George Ralph, <i>younger of Tulli- body</i>	1825
	ABERCROMBY, The Right Hon. James, Speaker of the House of Commons, and M. P. for the City of Edin- burgh	1834
	AGNEW, Sir Andrew, <i>of Lochnaw</i> , Bart. M. P. for Wig- toushire	1829
	ABERCROMBY, Sir Robert, <i>of Birkenbog and Forglen</i> , Bart.	1816
	ANTROBUS, Sir Edmund, <i>of Rutherford</i> , Bart.	1829
	ANSTRUTHER, Sir Ralph Abercromby, <i>of Balcaskie and Watten</i> , Bart.	1832
	ADAM, Vice-Admiral Sir Charles, <i>of Barns</i> , M. P. for Kinross-shire, K. C. B.	1829
	Adair, John, <i>of Genock</i>	1829
20	Adam, James, W. S.	1807
	Agnew, Colonel Vans, <i>of Sheuchan</i>	1829
	Ainslie, Major-General George	1803
	Ainslie, John, <i>of Maxpofle</i>	1831
	Ainslie, P. B., <i>residing at Donibristle House</i>	1826
	Aitchison, Francis, Merchant, <i>Leith</i>	1831
	Aitchison, James, <i>St Clement's Wells</i>	1822

		Admitted
	Aitchison, William, <i>younger of Drumcree</i>	1809
	Aitchison, William, <i>at Menzion</i>	1835
	Aitken, James, <i>Gartcous</i>	1834
30	Aiton, Rev. Dr John, Minister of <i>Dolphington</i>	1828
	Alcock, Robert, Advocate, <i>Aberdeen</i>	1833
	Alexander, Boyd, third son of the late Claud Alexander, <i>of Ballymyle</i>	1823
	Alexander, Claud, <i>of Ballymyle</i>	1810
	Alexander, Captain James Edward, <i>late 16th Lancers</i>	1831
	Alexander, W. Maxwell, <i>of Southbar</i>	1823
	Allan, Alexander, Advocate	1833
	Allan, John, <i>of Linkfield</i>	1824
	Allan, William, <i>of Glen and Hillside</i>	1830
	Allardyce, Robert Barclay, <i>of Urie</i>	1810
40	Allardes, James, <i>of Boynsmill</i>	1830
	Allen, James, Merchant, <i>Grangemouth</i>	1815
	Allen, Lieut.-Col. James, <i>of Inchmartin</i>	1821
	Allen, John Lee, <i>of Errol</i>	1821
	Alston, John, Manufacturer, <i>Glasgow</i>	1827
	Alston, Robert Douglas, Merchant, <i>Glasgow</i>	1836
	Alves, Archibald, <i>late of Springfield</i>	1797
	Anderson, Adam, LL.D. Rector of Perth Academy	1829
	Anderson, Adam, Advocate, Sheriff of Perthshire	1834
	Anderson, Alex. <i>of Gortheloch</i>	1823
50	Anderson, Major Alexander, <i>of Kingask</i> , H. E. I. C. S.	1833
	Anderson, David, <i>of Moredun</i>	1825
	Anderson, David, <i>of St Germain's</i>	1829
	Anderson, George, Iron-foundry, <i>Leith Walk</i>	1827
	Anderson, Michael, Coates House, <i>Edinburgh</i>	1831
	Anderson, Thomas, <i>of Craiganee</i> , Advocate	1832
	Anstruther, James, W. S.	1827
	Arbuthnot, James Carnegie, <i>of Balnamoon</i>	1813
	Arbuthnot, Thomas, <i>of Meethall</i>	1829
	Armstrong, Charles, <i>of Cherry Valley, County of Antrim,</i> <i>Ireland</i>	1836
60	Arnott, G. A. Walker, <i>of Arlary</i>	1837
	Arnott, James, <i>of Leithfield</i> , W. S.	1835
	Aytoun, Roger, W. S.	1820
	Aytoun, Roger, Banker, <i>Greenock</i>	1826

B

BEDFORD, His Grace John, Duke of, K.G. Hon. Mem.	1824
BEDFORD, Her Grace Georgina, Duchess of	1834

	* BUCCLEUCH and QUEENSBERY, His Grace Walter Francis, Duke of, K. G.	1828
	BUCCLEUCH and QUEENSBERY, Her Grace Charlotte, Duchess of	1835
	† BUTE, The Most Noble John, Marquis of	1815
	† BREADALBANE, The Most Noble John, Marquis of	1819
70	BUCHAN, The Right Hon. Henry David, Earl of	1811
	BELHAVEN and STENTON, The Right Hon. Robert, Lord	1816
	BEXLEY, The Right Hon. Nicholas, Lord, Hon. Mem.	1801
	BOYLE, Right Hon. David, Lord Justice-Clerk	1804
	BALGRAY, The Hon. Lord	1800
	BRUCE, Sir Michael, of <i>Scotstown and Stenhouse</i> , Bart.	1825
	BLAIR, Sir David Hunter, of <i>Brownhills</i> , Bart.	1801
	BAIRD, Dame Ann Preston Campbell, Lady, of <i>Fernton</i>	1809
	BAILLIE, Sir William, of <i>Polkemmet</i> , Bart.	1818
	BURNETT, Sir Thomas, of <i>Leys</i> , Bart.	1824
	BANNERMAN, Sir Alexander, of <i>Elsick</i> , Bart.	1835
80	BALLINGALL, Sir George, M. D., Prof. of Military Surgery in the University of Edinburgh	1821
	BERESFORD, Admiral Sir John P., Bart. M.P. K. C. B.	1822
	BOSWELL, Sir James, of <i>Auchinleck</i> , Bart.	1834
	BRISBANE, Lieutenant-General Sir Thomas M., of <i>Brisbane and Makerstoun</i> , Bart. G. C. B.	1801
	Badenach, Robert, of <i>Thornilee</i> , Surgeon to H.M. Forces	1833
	Baikie, James, of <i>Tankerness</i>	1818
	Bailie, Charles, Advocate	1831
	Bailie, Ewen, younger of <i>Dochfour</i>	1824
	Bailie, George, of <i>Jerviswood</i>	1800
	Baillie, Robert Granberry, of <i>Coulterallers</i>	1819
90	Baird, Rev. Dr George H., Principal of the University of Edinburgh, Chaplain of the Society	1793
	Baird, John, of <i>Shotts Iron-Works</i>	1815
	Bald, Robert, Civil-Engineer, <i>Edinburgh</i>	1828
	Balfour, Francis, of <i>Fernie</i>	1824
	Balfour, James, of <i>Whittinghame</i>	1821
	Balfour, James, of <i>Pilrig</i> , W. S.	1824
	Balfour, John, of <i>Trenaby</i>	1822
	Balfour, Major-General Robert, of <i>Balbirnie</i>	1830
	Balfour, Thomas, of <i>Elwick</i> , M. P.	1832
	Balfour, Captain William, of <i>Elwick</i>	1819
100	Balfour, William, Merchant, <i>Glasgow</i>	1820
	Ballandene, James, of <i>Pitgover</i>	1834
	Ballantyne, James, younger of <i>Castlehill</i> , Advocate	1822

		Admitted
	Ballantyne, James, <i>of Holylee</i>	1832
	Bannerman, Alexander, <i>of Burnieboozle</i> , M. P. for the City of Aberdeen	1835
	Bannerman, Andrew, <i>Tullibardine</i>	1835
	Bannerman, Charles, <i>of Crimmonmogate</i>	1828
	Bannerman, Patrick, Advocate, <i>Aberdeen</i>	1825
	Barclay, George Robertson, <i>of Keavil</i>	1834
	Barker, John, Banker, <i>Dumfries</i>	1837
110	Barns, Major-General James Stevenson, <i>of Kirkhill</i>	1803
	Bartlemore, Alexander, <i>of Seaside</i>	1825
	Bauchope, Robert, Factor for his Grace the Duke of Hamilton, <i>at Kinneil</i>	1831
	Baxter, Henry, <i>of Idvies</i> , Advocate	1834
	Bayley, Isaac, S. S. C.	1828
	Bayne, Dr James, Physician, <i>Inverness</i>	1813
	Beatson, David, <i>of Kirkpottie</i>	1828
	Beatson, H. Dundas, Captain, Swift Revenue Cutter,	1809
	Beatson, Thomas, <i>of Mawhill</i>	1829
	Begbie, Alexander, <i>of Pinnaclehill</i>	1832
120	Beith, John, Banker, <i>Campbeltown</i>	1826
	Beith, John, Junior, Banker, <i>Campbeltown</i>	1836
	Belches, Alexander Hepburn Murray, <i>of Invermay</i>	1824
	Belches, Lieut.-Colonel John H. Murray, <i>Invermay</i>	1825
	Bell, Archibald, Advocate, Sheriff of Ayrshire	1833
	Bell, Carlyle, W. S., one of the Principal Clerks of the City of Edinburgh	1824
	Bell, George Graham, <i>of Crurie</i> , Advocate	1835
	Bell, Geo. Jos., Professor of the Law of Scotland, Uni- versity of Edinburgh	1802
	Bell, George, Merchant, <i>Leith</i>	1826
	Bell, Robert, Advocate, Procurator for the Church of Scotland	1823
130	Bell, William, <i>of Hunthill</i> , W. S.	1813
	Berry, William, <i>of Tayfield</i>	1800
	Bertram, William, <i>at Cranshaws</i>	1826
	Bethune, Gilbert, <i>of Balfour</i>	1806
	Beveridge, Thomas, Depute-Clerk of Session	1816
	Beveridge, Thomas Knox, W. S.	1833
	Binning, Alex. Monro, W. S.	1833
	Binning, David Monro, <i>of Softlaw</i> , one of the Commis- sioners of the Customs, London	1799
	Binning, George Monro, <i>younger of Softlaw</i> , Advocate	1831
	Binny, John, <i>Moray Place, Edinburgh</i>	1835

		Admitted
140	Blackburn, John, of Killcarn	1827
	Blaikie, Francis, <i>Tower Cottage, Melrose</i>	1833
	Blackwood, Alexander, Bookseller, <i>Edinburgh</i>	1835
	Blackwood, Alexander Thomas, <i>of Ogcastle</i>	1836
	Blackwood, Robert, Bookseller, <i>Edinburgh</i>	1835
	Blair, David Anderson, <i>of Inchyra</i>	1819
	Blair, David, <i>of Cookston</i>	1826
	Blair, James, <i>of Penninghame</i>	1827
	Blair, Colonel Thomas Hunter, <i>of Dunskey</i>	1835
	Blair, William, <i>of Blair</i>	1821
150	Blair, William, <i>of Aronton</i>	1817
	Blamire, William, <i>of Thackwood</i> , late M.P. for Cumberland	1833
	Blandon, Michel de, <i>St Petersburg</i> , Honorary Member,	1836
	Blane, Robert, <i>of Grougar</i> , 2d Life Guards	1836
	Blood, Bindon, Esq. <i>of Cranaker, Clare, Ireland</i>	1833
	Bonar, Andrew, Banker, <i>Edinburgh</i>	1824
	Bonar, James, <i>of Kimmerghame</i>	1835
	Bonar, William, Banker, <i>Edinburgh</i>	1828
	Bontine, R. Cunningham, <i>of Ardoch</i>	1823
	Borthwick, George Augustus, M.D., <i>Edinburgh</i>	1817
160	Borthwick, John, <i>of Crookston</i>	1812
	Borthwick, William Hay, <i>of Hopesrig</i>	1821
	Boswall, Captain John Donaldson, <i>of Wardie</i> , R. N.	1814
	Boswell, John, <i>of Kingcaussie and Balmuto</i>	1823
	Boswell, John Douglas, <i>of Garallan</i>	1836
	Boswell, William, Advocate, Sheriff of Berwickshire	1803
	Bowie, John, <i>of Camsiscan</i> , W. S.	1815
	Boyd, Edward, <i>of Mertonhall</i>	1813
	Boyd, John, <i>of Broadmeadows</i>	1804
	Boyle, Colonel John, <i>of Shewalton</i>	1801
170	Boyle, Patrick, Advocate	1835
	Brander, Lieut.-Col. James, <i>of Pitgaveny</i>	1827
	Brander, James, Banker, <i>Golspie</i>	1830
	Brebner, James, Advocate, <i>Aberdeen</i>	1834
	Bremner, Charles, W. S.	1800
	Briggs, Lieut.-Col. John Falconer, <i>of Strathairly</i>	1828
	Brodie, Alexander, <i>Barnie Mains</i>	1822
	Brodie, James Campbell, <i>of Lethen</i>	1831
	Brodie, John, <i>of Scoughall</i>	1822
	Brodie, Peter, <i>of Clairlaw</i>	1834
180	Brodie, William, <i>of Brodie</i>	1821
	Brodie, William, <i>Upper Keith</i>	1822
	Brown, Alex., Merchant, <i>Aberdeen</i>	1825

		Admitted
	Brown, Alexander, Secretary Morayshire Farmer Club	1832
	Brown, Captain David, <i>of Park</i>	1834
	Brown, George, <i>of Blairfield</i>	1828
	Brown, Hugh, <i>of Broadstone, Ayrshire</i>	1823
	Brown, Lieutenant J. D., <i>Markle, East Lothian</i>	1821
	Brown, James, Accountant, <i>Edinburgh</i>	1816
	Brown, John, <i>of Coultermains</i>	1807
190	Brown, John Osborn, W.S.	1799
	Brown, Matthew, <i>Port-Glasgow</i>	1832
	Brown, Peter, <i>Linkwood, Elgin</i>	1821
	Brown, Robert, Factor on the Estate of Hamilton	1802
	Brown, Capt. Samuel, R. N., <i>of Netherbyres</i>	1829
	Brown, Thomas, <i>of Lanfine and Waterhaughs</i>	1832
	Brown, William, Merchant, <i>Glasgow</i>	1828
	Brown, William, Banker, <i>Maybole</i>	1835
	Brown, William Henry, <i>of Ratho Bank</i>	1833
	Bruce, Charles Lennox Cumming, <i>of Roseile and Kin-</i> <i>naird, M.P.</i>	1817
200	Bruce, John, <i>younger of Sumburgh</i>	1829
	Bruce, Oneziphorous Tyndall, <i>of Falkland</i>	1829
	Bruce, Robert, <i>of Symbister, Zetland</i>	1807
	Bruce, Robert, <i>of Kennet</i>	1819
	Bruce, Robert, Advocate, Sheriff of Argyllshire	1828
	Bruce, Thomas, <i>of Arnot</i> , late one of the Commissioners of Customs for Scotland	1820
	Bruce, Thomas, <i>of Langlee, W. S.</i>	1828
	Bryce, Rev. James, D.D., formerly Minister of the Scots Church, <i>Calcutta</i>	1813
	Buchan, George, <i>of Kelloe</i>	1826
	Buchan, Robert, <i>George Street, Edinburgh</i>	1817
210	Buchanan, Alexander, <i>Arnprior</i>	1819
	Buchanan, Andrew Carrick, <i>at Drumpellier</i>	1827
	Buchanan, the Rev. George Craig, <i>of Mackeanston</i>	1814
	Buchanan, George, <i>of Finnich Melise</i>	1830
	Buchanan, Jas., <i>late of Buenos Ayres, residing at Edinburgh</i>	1820
	Buchanan, John, <i>of Ardoch</i>	1805
	Buchanan, John Cross, <i>of Auchintoshan</i>	1824
	Buchanan, John, Wine-Merchant, <i>Glasgow</i>	1827
	Buchanan, John, <i>at Finnich</i>	1831
	Buchanan, Peter, <i>of Auchmar</i>	1818
220	Buchanan, Robert Carrick, <i>of Drumpellier</i>	1827
	Buchanan, Robert, <i>Glasgow</i>	1811
	Buchanan, Thomas, <i>of Powis</i>	1833

		Admitted
	Buchanan, William, Merchant, <i>Glasgow</i>	1828
	Burn, James, W. S.	1825
	Burn, William, Architect, <i>Edinburgh</i>	1824
	Burnett, Alexander, <i>at Crathes</i>	1834
	Burnett, James Horn, W. S.	1834
	Burnett, John, <i>of Kemnay</i>	1809
	Burnett, Joseph, <i>of Gadgirth</i>	1836
230	Burnett, Newell, Advocate, <i>Aberdeen</i>	1834
	Burnett, General William, <i>of Banchory Lodge</i>	1813
	Burnett, Thomas, Advocate, <i>Aberdeen</i>	1825
	Burnett, Captain William, R. N.	1834
	Burt, Dr Robert, Physician, <i>Edinburgh</i>	1813
	Burt, John, Surgeon Extraordinary to the King, <i>Edinburgh</i>	1831
	Butter, Archibald, <i>of Faskally</i>	1825

C

	CHANDOS, The Most Hon. Richard Plantagenet, Marquis of, Honorary Member,	1837
	CAITHNESS, The Right Hon. Alexander, Earl of	1814
	CATHCART, General, Right Hon. William, Earl of, K.T.	1807
240†	CAWDOR, The Right Hon. John Frederick, Earl of	1831
	CAMPBELL, The Right Hon. Lord John	1798
	COREHOUSE, The Honourable Lord	1819
	CATHCART, Colonel, The Hon. Frederick Macadam, <i>of Craigengillan</i>	1830
	CARMICHAEL, Sir Thomas Gibson, <i>of Castlecraig</i> , Bart.	1806
	CUNNINGHAME, Colonel Sir James Montgomery, <i>of Corsehill</i> , Bart.	1807
	CLERK, Sir George, <i>of Penicuik</i> , Bart. M. P. for Edinburghshire	1812
	COLQUHOUN, Sir James, <i>of Luss</i> , Bart.	1829
	CAMPBELL, Sir Archibald, <i>of Succoth</i> , Bart.	1813
	CAMPBELL, Sir John, <i>of Airds</i> , Bart.	1829
250	CAMPBELL, Sir Hugh Purves Hume <i>of Marchmont</i> , Bart. M.P. for Berwickshire	1834
	CATHCART, Sir John Andrew, <i>of Carleton</i> , Bart.	1834
	CAMERON, Sir Duncan, <i>of Fasfern</i> , Bart.	1800
	CAMPBELL, Sir Donald, <i>of Dunstaffnage</i> , Bart.	1823
	CAMPBELL, Lieut.-General Sir Colin, K.C.B.	1816
	COCHRANE, Captain Sir Thomas, Royal Navy, K. C. B.	1817
	CAMPBELL, Sir James, G. C. B.	1797
	CAMPBELL, Vice-Admiral Sir Patrick, K. C. B.	1819

	CAMPBELL, Sir John, Attorney-General, M. P. for the City of Edinburgh	1834
	CREWE, Sir George, Bart. of Calke Abbey, Derbyshire	1833
260	Caird, James, of Drumfad	1814
	Calderwood, Thomas Durham, of Polton	1822
	Callender, James Henry, of Craigforth	1830
	Callender, William Burn, of Prestonhall	1818
	Cameron, Alexander, Surinam	1819
	Cameron, Allan, North Uist	1803
	Cameron, Donald, of Lochiel	1834
	Cameron, Donald Charles, of Foxhall	1825
	Cameron, Gordon, of Letterfindlay	1806
	Cameron, Hugh Innes, Provost of Dingwall	1835
270	Cameron, John, Corrychoiley and Gleneaves	1826
	Cameron, Lieutenant-Colonel Robert, late of Madras	1804
	Campbell, Lieutenant-Colonel Alexander, of Possil	1810
	Campbell, Captain Alexander, of Brackley	1806
	Campbell, Alexander, London	1804
	Campbell, Alexander, of Edderline	1807
	Campbell, Alexander, of Monzie	1833
	Campbell, Alexander, of Bedlay	1833
	Campbell, Alexander, of Barnhill	1833
	Campbell, Alexander, George Square, Edinburgh	1835
280	Campbell, Alexander Brodie, of Fornightly, Hon. East India Company's Service	1816
	Campbell, Archibald, Jura	1834
	Campbell, Archibald, of Blythswood	1800
	Campbell, Archibald, of Catrinebank	1810
	Campbell, Archibald James, of Kilpatrick	1824
	Campbell, Archibald, of Glendaruel	1826
	Campbell, Archibald, Camusearnie Cottage, Factor on the estate of Menzies	1832
	Campbell, Arthur, W. S.	1816
	Campbell, Charles, of Combie	1808
	Campbell, Colin, Jura, Albryn Place, Edinburgh	1810
290	Campbell, Colin, of Cumiseskan, Edinburgh	1829
	Campbell, David, Mount-Hamilton	1835
	Campbell, Lieut.-Colonel Donald, of Knock	1806
§	Campbell, General Duncan, of Locknell	1784
	Campbell, Lieut.-Colonel Dugald, Royal Artillery	1818
	Campbell, Duncan, of Ross, Advocate	1823
	Campbell, George, Son of Sir Archibald Campbell of Succoth, Bart.	1833

		Admitted
	Campbell, George James, <i>of Treesbanks</i>	1835
	Campbell, Henry Fletcher, <i>of Boquhan</i>	1823
	Campbell, James Archibald, <i>of Inverawe</i>	1833
300	Campbell, James Muir, <i>Ayr</i>	1825
	Campbell, James, <i>of Jura</i>	1827
	Campbell, James, <i>of Craigie</i> , Advocate	1824
	Campbell, John, <i>of Craignure</i>	1803
	Campbell, John, <i>of Stonefield</i>	1808
	Campbell, John, <i>of Glen Saddel</i>	1817
	Campbell, John, <i>of Blairhall</i>	1819
	Campbell, John, <i>of Southhall</i>	1821
	Campbell, John, <i>younger of Otter</i>	1827
	Campbell, John, <i>of Strachur</i>	1829
310	Campbell, Colonel John, <i>of Blackhall</i>	1803
	Campbell, John Deans, <i>of Curreath and Loeg</i> ,	1835
	Campbell, John Archibald, W. S.	1813
	Campbell, John, <i>of Carbrook</i> , W. S.	1793
	Campbell, John, <i>of Lincoln's Inn</i>	1800
	Campbell, John, W. S. <i>now of London</i>	1787
	Campbell, John, <i>late of Lochend</i>	1803
	Campbell, Lorne, Factor to the Duke of Argyle <i>at Rose- neath</i>	1824
	Campbell, Mungo Nutter, <i>of Ballymore</i>	1824
	Campbell, Mungo, <i>of Hallyards</i>	1832
320	Campbell, Captain Peter, <i>of Askomell</i>	1819
	Campbell, Richard, <i>of Auchnabreck</i> , W. S.	1833
	Campbell, Richard D. <i>Jura</i>	1836
	Campbell, Lieut.-General Robert, <i>of Kintarbert</i>	1789
	Campbell, Robert Nutter, <i>of Kailzie</i>	1798
	Campbell, Robert, <i>of Sonochan</i>	1802
	Campbell, Robert, <i>younger of Auchmannoch</i>	1816
	Campbell, Rose, <i>late of Spain</i>	1809
	Campbell, Walter Frederick, <i>of Islay</i> , M.P. for Argyleshire	1817
	Campbell, Walter, <i>of Sunderland</i>	1818
330	Campbell, Captain Walter, <i>of Skipness</i>	1836
	Campbell, William, <i>of Netherplace</i>	1810
	Campbell, William, W. S.	1805
	Campbell, William, Clerk of Supply for Argyleshire	1836
	Campbell, William L., <i>of Glenfalloch</i>	1833
	Canning, James, <i>residing at Shields</i>	1813
	Carlisle, William, <i>of Houstonfield</i>	1835
	Carmichael, Maurice, <i>of Eastend</i>	1827
	Carmichael, Michael, <i>younger of Eastend</i>	1825

		Admitted
	Carnaby, Thomas, General Clerk of Lieutenancy, <i>Forfar-shire</i>	1831
340	Carnegie, John, of <i>Redhall</i>	1836
	Carnegy, David, of <i>Craigo</i>	1827
	Carnegy, Patrick Watson, of <i>Lower and Turin</i>	1836
	Carnegy, William Fullarton Lindsay, of <i>Boysack</i>	1824
	Carruthers, Alexander, of <i>Warmanbie</i>	1826
	Carruthers, William Thomas, of <i>Dormont</i>	1823
	Cassels, David, of <i>Arnprior</i>	1824
	Cathcart, Elias, of <i>Blairston</i> , Advocate,	1819
	Cathcart, James, Merchant, <i>Leith</i>	1805
	Chalmers, Charles, of <i>Monkshill, Aberdeen</i>	1824
350	Chalmers, David, of <i>Westburn</i>	1834
	Chalmers, Patrick, of <i>Auldbar</i> , M. P.	1834
	Chalmers, Lieutenant-Colonel W., of <i>Glenaricht</i>	1822
	Chalmers, Lewis, <i>Fraserburgh</i> , Factor for Lord Saltoun	1833
	Chancellor, Alexander, of <i>Shieldhill</i>	1818
	Charge, Thomas, of <i>Bartom</i>	1833
	Cheape, Captain John, of <i>Girgenti</i>	1814
	Cheape, George, of <i>Wellfield</i>	1834
	Cheine, Patrick, <i>Great King Street, Edinburgh</i>	1820
	Cheyne, Captain Alexander, Royal Engineers	1825
360	Cheyne, James Auchinleck, of <i>Oxendean</i> , W. S.	1825
	Chisholm, Lachlan, of <i>Irin</i>	1831
	Chisholm, Alexander William, of <i>Chisholm</i> , M. P. for In- verness-shire	1831
	Christie, James, <i>Hillend</i> , late Hon. E. I. Co.'s Service	1835
	Christie, Robert, Accountant, <i>Edinburgh</i>	1824
	Christie, William Macpherson, <i>Ballimore</i>	1837
	Chrystie, Alexander, late Commander of the Hon. E. I. Co.'s Ship Thomas Coutts	1834
	Clapperton, Thomas, Merchant, <i>Edinburgh</i>	1837
	Clark, James, of <i>Boxton</i>	1834
	Clark, Robert, of <i>Comrie</i>	1810
370	Clason, Andrew, W. S.	1820
	Cleghorn, George, of <i>Weens</i>	1821
	Cleland, James, LL. D., <i>Glasgow</i>	1827
	Cockburn, Patrick, Accountant, <i>Edinburgh</i>	1824
	Coke, Thomas William, of <i>Holkham Hall</i> , Hon. Mem.	1837
	Collier, Thomas, <i>Hatton</i> , Factor to the Right Hon. Lord Panmure	1835
	Colquhoun, John Campbell, of <i>Killermont</i>	1824

		Admitted
	Colquhoun, John, Advocate, Sheriff of Dumbartonshire	1807
	Colt, John Hamilton, <i>of Gartsherrie</i>	1834
	Connell, James, <i>of Conheath</i>	1828
380	Cooper, Samuel, <i>of Ballindalloch</i>	1818
	Copland, David, Merchant, <i>Aberdeen</i>	1837
	Copland, William, <i>of Collieston</i>	1836
	Corrie, Thomas, <i>of Culloch</i> , Manager British Linen Co.	1826
	Coulter, John, <i>Tylefield</i> , <i>Glasgow</i>	1833
	Couper, Peter, W. S.	1811
	Cowan, Alexander, Merchant, <i>Edinburgh</i>	1810
	Cowan, Charles, <i>Valleyfield</i>	1836
	Cowan, Duncan, Merchant, <i>Edinburgh</i>	1810
	Craig, Alexander, Merchant, <i>Edinburgh</i>	1818
390	Craig, Alexander, <i>Kirkton</i>	1821
	Craig, John, Merchant, <i>Edinburgh</i>	1818
	Craig, William Gibson, <i>younger of Riccarton</i>	1824
	Craigie, Lawrence, <i>of Glendoick</i>	1824
	Craigie, William Burnett, <i>of Linton</i>	1836
	Crawfurd, James, <i>younger of Ardmillan</i> , Advocate	1835
	Crawford, Charles, <i>East Fortune</i>	1822
	Crawford, John Innes, <i>of Bellfield</i>	1815
	Crawford, John, <i>Sherpittlaw House</i> , near <i>Kelso</i>	1826
	Crawford, John, <i>of Auchinames</i>	1818
400	Crawford, William, <i>of Doonside</i>	1836
	Crawford, William Macknight, <i>of Cartsburn</i>	1809
	Crawford, William Howison, <i>of Crawfordland</i>	1809
	Crawfurd, John, late British Resident at Java	1819
	Crichton, Thomas, <i>of Auchinskeoch</i> , Advocate, Chamberlain to the Duke of Buccleuch	1795
	Crombie, Rev. Dr Alexander, <i>of Phesdo</i>	1834
	Crombie, Alexander, <i>younger of Phesdo</i>	1835
	Crombie, Lewis, <i>Aberdeen</i>	1834
	Crookshanks, Alexander, <i>of Keithock</i>	1836
	Crow, James, <i>at Kincaig</i>	1826
410	Cruickshanks, James, <i>of Langley park</i>	1829
	Cumming, Alexander, <i>of Grishernish</i>	1837
	Cunninghame, John, His Majesty's Solicitor-General for Scotland	1833
	Cunningham, Colonel John, <i>of Newton</i>	1829
	Cunningham, John, <i>of Duchrae</i>	1830
	Cunningham, John Sinclair, Banker, <i>Edinburgh</i>	1833
	Cunningham, John Smith, <i>of Caprington</i>	1835
	Cunningham, Thomas Smith, <i>younger of Caprington</i>	1835

		Admitted
	Cunningham, William, <i>of Lainshaw</i>	1810
	Cunningham, William, <i>at Goodleyburn</i>	1830
420	Cunningham, William, <i>of Craighends</i>	1828
	Cunningham, William, <i>younger of Enterkine</i>	1836
	Currie, Alexander, Advocate, Sheriff of Banffshire	1836
	Currie, William, <i>of Linthill</i>	1832
	Cuthbertson, Archibald, <i>Peanston</i>	1822
	Cuthbertson, Donald, Accountant, <i>Glasgow</i>	1827
	Cuthbertson, James, <i>Seton Mains</i>	1824
	Cuthbertson, William, <i>Glasgow</i>	1836

D

	DECAZES, The Duc, Peer of France, President of the Council of Agriculture, Honorary Member	1836
	DOWNSHIRE, The Most Noble Arthur, Marquis of, K. P., Honorary Member	1837
430	DOUGLAS and CLYDESDALE, The Most Noble, William Anthony Alexander, Marquis of	1834
†	DALHOUSIE, General the Right Hon. George, Earl of, G. C. B.	1804
	DUNMORE, The Right Hon. Alexander Edward, Earl of,	1837
	DALMENY, The Right Hon. Archibald, Lord, M. P.	1833
§	DUFFUS, The Right Hon. Benjamin, Lord,	1784
	DOUGLAS, The Right Hon. Archibald, Lord	1825
	DUNDAS, The Right Hon. Lawrence, Lord,	1800
	DUNDAS, The Right Hon. Wm., Lord Clerk-Register	1801
	DUFF, Lieutenant-General the Hon. Sir Alexander	1814
	DOUGLAS, Hon. Charles, <i>of Douglas</i>	1806
440	DUNBAR, The Hon. Robert, <i>of Latheron Wheel</i>	1832
	DALYELL, Sir James, <i>of Binns</i> , Bart.	1798
	DALRYMPLE, Lieutenant-General Sir John Hamilton, <i>of Cranstoun and Cousland</i> , Bart.	1817
	DUNBAR, Sir Archibald, <i>of Northfield</i> , Bart.	1794
	DICK, Sir Robert Keith, <i>of Prestonfield</i> , Bart.	1816
	DUNDAS, Sir David, <i>of Dunira</i> , Bart.	1828
	DRUMMOND, Sir F. Walker, <i>of Hawthornden</i> , Bart.	1823
	DURHAM, Vice-Admiral Sir P. Henderson, <i>of Fordel</i> , G. C. B.	1823
	DALLAS, Major-General Sir Thomas, Kt.	1805
	D'ESTE, Colonel Sir Augustus Frederick	1822
450	DICK, Major-General Sir R. H. <i>of Tullimet</i> , K. C. B.	1828
	DALYELL, Sir John Graham, Kt. Advocate	1807
	Dalgairns, Andrew, <i>at Ingliston</i>	1833

		Admitted
	Dallas, James, Merchant, <i>Edinburgh</i>	1819
	Dalyell, John, <i>of Lingo</i>	1823
	Dalzell, James Allan, Madras Civil Service	1835
	Darling, Thomas, S. S. C.	1821
	Darroch, Lieutenant-General Duncan, <i>of Gourock</i>	1830
	Daubeny, Robert Henry, <i>of Bristol</i>	1826
	Davidson, Duncan, <i>of Tulloch</i>	1824
460	Davidson, Duncan, <i>of Tillychety</i>	1824
	Davidson, Hugh, <i>of Cantray</i>	1831
	Davidson, James, Keeper of the Records of the Court of Session	1834
	Davidson, James Gillespie, W. S.	1819
	Davidson, Laurence, W. S.	1829
	Davidson, Patrick, <i>younger of Tillychety</i>	1834
	Davidson, Robert, Advocate	1819
	Davidson, William, <i>Stanstill</i>	1833
	Dempster, George, <i>of Skibo</i>	1823
	Dennistoun, James, <i>of Dennistoun</i>	1829
470	Dewar, Alexander Cumming, <i>Vogrie</i> , 15th Regiment Bengal Native Infantry	1832
	Dewar, John, Advocate	1830
	Dick, John, Advocate	1827
	Dick, William, <i>younger of Pitkarro</i>	1828
	Dickson, Andrew, <i>of Alton</i>	1823
	Dickson, Archibald, <i>of Huntlaw</i>	1823
	Dickson, George, late Merchant, <i>Calcutta</i>	1830
	Dickson, George, <i>of Belchester</i>	1831
	Dickson, James Wardrobe, Advocate	1834
	Dingwall, John Duff, <i>of Brucklay</i>	1833
480	Dirom, Captain Alexander, <i>of Mountannan</i>	1835
	Dixon, John, <i>of Daldowie</i> , Merchant, <i>Glasgow</i>	1827
	Dixon, William, <i>of Govan</i> , Merchant, <i>Glasgow</i>	1827
	Dodd, William, Merchant, <i>Glasgow</i>	1837
	Donaldson, John, <i>of Auchairn</i> , W. S.	1812
	Donaldson, John, Advocate	1835
	Douglas, Archibald, <i>of Adderstone</i>	1822
	Douglas, Archibald, <i>of Glenfinart</i>	1836
	Douglas, George, Advocate, Sheriff of Kincardineshire	1800
	Douglas, James, <i>of Cavers</i>	1835
490	Douglas, John, <i>of Lockerby</i>	1825
	Douglas, Lieut.-Col. William, late of the 85th Regt.	1803
	Douglas, William Robert Keith, <i>of Denino</i>	1819
	Downie, Alexander, Merchant, <i>Glasgow</i>	1835

		Admitted
	Downie, Robert, <i>of Appin</i>	1814
	Dron, William, <i>of Blackruthven</i>	1829
	Drummond, Vice-Admiral Adam, <i>of Megginch</i>	1822
	Drummond, George Harley, <i>late of Drumtochty</i>	1810
	Drummond, George Home, <i>younger of Drummond</i>	1835
	Drummond, Henry Home, <i>of Blair Drummond</i>	1809
500	Drummond, James, <i>of Strageath</i>	1836
	Drummond, James Walker, <i>younger of Hawthornden,</i> 1st Grenadier Guards	1834
	Drummond, John George, <i>of Abbotsgrange</i>	1835
	Drummond, Thomas, <i>younger of Newton</i>	1828
	Drummond, William, Banker, <i>Cupar Fife</i>	1837
	Dudgeon, Patrick, <i>of Eastcraigs, W. S.</i>	1827
	Dudgeon, Robert, Merchant, <i>Liverpool</i>	1828
	Dudgeon, William, Merchant, <i>Leith</i>	1826
	Duff, Adam, Advocate, Sheriff of Edinburgh	1813
	Duff, Arthur, <i>of Cocklaw</i>	1832
510	Duff, Garden, <i>of Hatton</i>	1814
	Duff, James Grant, <i>of Eden</i>	1828
	Duff, Robert, <i>of Fetteresso</i>	1823
	Duff, Richard Wharton, <i>of Orton</i>	1805
	Duff, Thomas Abercromby, <i>of Haddo</i>	1835
	Dunbar, Major P. 3d Regiment of Bengal Cavalry	1823
	Duncan, Alexander, <i>of Glendivine</i>	1824
	Duncan, James, <i>at Cargill</i>	1826
	Duncan, James, Merchant, <i>Leith</i>	1826
	Duncan, James J. <i>of Garthamlock</i>	1830
520	Dundas, Gabriel Hamilton, <i>of Duddingston</i>	1823
	Dundas, Robert, <i>of Arniston</i>	1820
	Dundas, Robert Adam	1825
	Dunlop, Alexander, Advocate	1828
	Dunlop, Archibald, Distiller, <i>Haddington</i>	1823
	Dunlop, Campbell, <i>Enterkine House</i>	1832
	Dunlop, James, <i>of Annanhill</i>	1824
	Dunlop, James, W. S.	1823
	Dunlop, John, <i>of Dunlop, M. P. for Ayrshire</i>	1835
	Dunlop, John, <i>of Brockloch</i>	1836
530	Dunlop, John Colin, Advocate, Sheriff of Renfrewshire	1824
	Dunlop, William, Merchant, <i>Edinburgh</i>	1820
	Dunn, William, <i>of Kilbowie, Merchant, Glasgow</i>	1827
	Dunsmure, James, Secretary Herring Fishery Board	1817
	Durham, General James, <i>of Largo</i>	1823
	Dyson, Thomas C. <i>of Willowfield, Halifax, Yorkshire</i>	1832

E

	ESTERHAZY, His Highness the Prince, <i>Hungary</i> , Honorary Member	1836
	ERROL, The Right Hon. George William, K. T. Earl of	1837
	EGLINTON, The Right Hon. Archibald, Earl of	1834
	† ELGIN & KINCARDINE, The Right Hon. Thomas, Earl of, K. C.	1818
540	ELIBANK, The Right Hon. Alexander, Lord	1836
	† ELCHO, The Right Hon. Francis, Lord	1819
	EGERTON, The Right Hon. Lord Francis, M. P.	1822
	ELPHINSTON, The Right Hon. John, Lord	1834
	ELLIOT, Sir William <i>of Stobbs</i> , Bart.	1823
	ELPHINSTON, The Hon. Mountstewart,	1833
	EDMONSTONE, Sir Archibald, <i>of Duntreath</i> , Bart.	1821
	ERSKINE, Sir David, <i>of Cambo</i> , Bart.	1835
	ELPHINSTON, Sir Robert Dalrymple Horn, <i>of Logie-Elphinstone</i> , Bart.	1813
	Eddington, James, <i>formerly of Gargunnoch</i>	1814
550	Eddington, Thomas, Merchant, <i>Glasgow</i>	1813
	Edmonstone, James, <i>of Newton</i>	1798
	Elder, John, Merchant, <i>Slate</i>	1815
	Ellice, Edward, <i>younger of Ardmellie</i>	1836
	Elliot, George Scott, <i>of Larriston</i>	1813
	Elliot, James, <i>of Wolfie</i>	1826
	Elliot, Theodore F., <i>Braco Castle</i>	1824
	Ellis, William, S. S. C.	1821
	Elphinstone, Lieutenant-Colonel John	1827
	Erschine, James, <i>of Cambus</i>	1808
560	Erschine, Col. William Howe Knight, <i>of Pitodrie</i>	1820
	Evans, James, <i>of Edmond Castle</i> , near Brampton	1832
	Ewing, James, <i>of Levenside</i>	1827
	Ewing Robert, Merchant, <i>Greenock</i>	1830
	Ewing, William Leckie, <i>of Shirgarton</i>	1835

F

	† FIFE, The Right Hon. James, Earl of, K. T.	1805
	FORBES, The Right Hon. James Ochonchar, Lord	1831
	FLEMING, Vice-Admiral the Hon. Charles Elphinstone, <i>of Biggar and Cumbernauld</i>	1824
	FORBES, The Hon. Walter, <i>Master of Forbes</i>	1833
	FLAHAULT, Charles, Count Mercer De	1821
570	FORBES, Sir John Stuart, <i>of Pitsligo and Fettercairn</i> , Bart. Treasurer of the Society	1830

		Admitted
	FORBES, Sir John, <i>of Craigievar</i> , Bart.	1832
	FERGUSON, Sir James, <i>of Kilkerran</i> , Bart.	1805
	FORBES, Sir Charles, <i>of New and Edinglassie</i> , Bart.	1814
	FOULIS, Sir James, <i>of Woodhall</i> , Bart.	1816
	FERGUSON, Sir Adam, Kt. Keeper of the Regalia	1799
	FARQUHAR, Rear-Admiral Sir Arthur, R. N. C. B.	1826
	Fairbairn, T., <i>late of St Vincent's</i>	1802
	Fairlie, James, <i>of Holmes</i>	1827
	Fairlie, James Ogilvie, <i>of Williamfield</i>	1836
580	Falconer, David, <i>of Carlowrie</i>	1807
	Falconer, Æneas, <i>Blackhills</i>	1810
	Falconer, Cosmo, <i>of Hartwoodhill</i>	1805
	Falconer, Peter, <i>at Cragelachie</i>	1821
	Farquhar, Lieut.-Colonel William, Madras Engineers, late British resident at Singapore	1827
	Farquharson, Archibald, <i>of Finzean</i>	1815
	Farquharson, James, <i>of Invercauld</i>	1831
	Farquharson, John, <i>of Haughton</i>	1808
	Farquharson, Peter, <i>of Whitehouse</i>	1833
	Farquharson, Thomas, <i>of Baldovie</i>	1836
590	Fellenberg, Emanuel de, <i>of Hofwyl</i> , Switzerland, Honorary Member	1836
	Ferrie, John, Merchant, <i>Greenock</i>	1831
	Fergus, John, <i>of Strathore</i> , M. P.	1832
	Ferguson, George, <i>of Pitfour</i> , M. P. for Banffshire	1828
	Ferguson, James, <i>of Kimmundy</i>	1826
	Ferguson, John, <i>of Stronvar</i>	1805
	Ferguson, John, <i>of Knockindale</i>	1824
	Ferguson, Robert, <i>of Raith</i> , M. P. for Haddingtonshire	1825
	Ferguson, Robert Cutlar, <i>of Craigdarroch</i> , M. P. for Kirkcudbrightshire	1826
	Ferguson, Adam, <i>of Woodhill</i>	1807
600	Fergusson, Charles, <i>younger of Kilkerran</i> , Advocate	1826
	Fergusson, James, <i>of Crosshill</i> , Principal Clerk of Session	1800
	Fergusson, James, W. S.	1826
	Fergusson, Lieutenant-Colonel James, <i>of Huntly Burn</i>	1831
	Fergusson, John, Wine-Merchant, <i>Leith</i>	1826
	Fergusson, Samuel R., W. S.	1836
	Fernie, James Blyth, <i>of Kilmux</i>	1836
	Ferrie, Robert, <i>of Blairtumnock</i>	1827
	Ferrier, Charles, <i>of Badingsgill</i> , Accountant	1833
	Ferrier, John, W. S.	1796
610	Finlay, Kirkman, <i>of Castle Toward</i>	1814

		Admitted
	Finlay, James, <i>younger of Castle Toward</i>	1826
	Finlay, William Warwick, <i>younger of Trees</i>	1826
	Fisher, Daniel, S. S. C.	1819
	Fisher, James, M. D., late Staff Surgeon to the Army in Canada	1821
	Fleming, Robert, <i>Minto Street, Edinburgh</i>	1829
	Fleming, William Malcolm, <i>of Borrochan</i> , Vice-Lieute- nant of the County of Renfrew	1832
	Flemyng, Robert Stewart, <i>of Killiechaspie</i>	1826
	Fletcher, Angus, <i>of Dunans</i> , Advocate	1826
	Flyter, Robert, Sheriff-Substitute Fort-William	1821
620	Fogo, David M., <i>of Row</i>	1809
	Forbes, Charles, <i>of Asloun</i> , second son of Sir Charles For- bes, Bart.	1828
	Forbes, Charles Henry, <i>of Kingerloch</i>	1836
	Forbes, George, Banker, <i>Edinburgh</i>	1817
	Forbes, George, <i>of Auchnagathil</i> , third son of Sir Charles Forbes, Bart.	1830
	Forbes, George, <i>of Springhill</i>	1835
	Forbes, James D., Professor of Natural Philosophy, Uni- versity of Edinburgh	1836
	Forbes, James Stewart, fourth son of Sir Charles Forbes, Bart.	1830
	Forbes, John, <i>younger of New and Edinglassie</i>	1828
	Forbes, Michie, <i>of Crimond</i>	1806
630	Forbes, Lieut.-General Nathaniel, <i>of Auchernach</i>	1828
	Forbes, Patrick, <i>of St Catharine's</i>	1834
	Forbes, William, <i>of Callander</i> , M. P. for Stirlingshire	1830
	Forbes, William, <i>younger of Medwyn</i> , Advocate	1835
	Fordyce, Thomas J., <i>of Ayton</i>	1828
	Forman, John, W. S.	1809
	Forman, John Nairne, W. S.	1831
	Forrest, James G., <i>of Comiston</i>	1805
	Forsyth, John, <i>Forres</i>	1826
	Fotheringham, Thomas Ogilvie, <i>of Pourie</i>	1824
640	Fouler, James, <i>of Raddrey</i>	1806
	Foulds, William, <i>of Skirnieland</i>	1833
	Fraser, Alexander, <i>of Inchcoulter</i>	1805
	Fraser, Alexander, Merchant, <i>Aberdeen</i>	1817
	Fraser, Captain Alexander, Royal Engineers	1818
	Fraser, Archibald Thomas Frederick, <i>of Abertarff</i>	1820
	Fraser, Colonel Charles, <i>of Inverallochy and Castle Fraser</i>	1816
	Fraser, George, Merchant, <i>Manchester</i>	1825

		Admitted
	Fraser, Hugh, <i>of Eskadale</i>	1819
	Fraser, John, Cashier, <i>Cullen House</i>	1812
650	Fraser, John, Advocate	1802
	Fraser, Robert, <i>of Torbreck</i>	1802
	Fraser, Simon, <i>of Ford</i> , Advocate	1828
	Fraser, Symon, <i>of Foyers</i>	1800
	Fraser, Captain Thomas, R. N.	1817
	Fraser, Captain William, <i>residing at Brackla</i>	1809
	Fraser, William, <i>of Glenmead</i> , W. S.	1816
	Fraser, William John, <i>at Allerlie</i>	1836
	Freeland, Robert, <i>of Gryffe Castle</i> , Merchant, Glasgow	1835
	Fullerton, Colonel S. M., <i>of Fullarton</i>	1825
660	Fullerton, John, <i>of Demerara, Brisbane House</i>	1825
	Fullerton, Captain James, 30th Regiment	1824
	Fullerton, John, <i>of Kilmichael</i>	1807
	Fullerton, William, <i>of Skeldon</i> , Advocate	1801
	Fyfe, Andrew, M. D., <i>Edinburgh</i>	1823
	Fyfe, James, <i>of Smithfield</i>	1806

G

	GORDON, Her Grace Elizabeth, Duchess of	1834
	† GALLOWAY, The Right Hon. Randolph, Earl of	1830
	† § GLASGOW, The Right Hon. George, Earl of	1784
	† GRAY, The Right Hon. Francis, Lord	1793
670	† GLENLYON, The Right Hon. James, Lord	1804
	GREENOCK, Major-General the Right Hon. Charles, Lord, C. B.	1809
	GLENELG, The Right Hon. Charles, Lord	1816
	GRAHAM, The Right Hon. Lord Montagu William	1831
	GRAHAM, The Right Hon. Sir James Robert George, <i>of Netherby</i> , Bart. M. P.	1830
	GORDON, Captain the Hon. William, R. N., M. P. for Aberdeenshire	1824
	GRANT, Colonel The Hon. Francis William, <i>of Grant</i> , M. P. for Morayshire	1803
	GRAY, The Hon. John, eldest son of Lord Gray	1821
	GILLIES, The Hon. Lord	1809
	GORDON, The Right Hon. Sir Robert, <i>of Balmoral</i> , G.C.B.	1834
680	GORDON, Sir James, <i>of Letterfourie</i> , Bart.	1800
	GORDON, Sir John, <i>of Earlston</i> , Bart.	1827
	GORDON, Sir William Cumming, <i>of Altyre and Gordon- ston</i> , Bart.	1808
	GIBSON, Sir Alexander C. Maitland, <i>of Cliftonhall</i> , Bart.	1818

	GRANT, Sir John Peter, <i>of Rothiemurchus</i> , Knight, Judge in the Supreme Court, <i>Calcutta</i>	1792
	Galbraith, William, <i>younger of Blackhouse</i> , Town-Clerk, <i>Stirling</i>	1822
	Galbreath, David Stewart, <i>of Mackrihanish</i>	1812
	Galloway, William, Accountant, <i>Edinburgh</i>	1814
	Garden, Alexander, Merchant, <i>Glasgow</i>	1827
	Gardiner, George, Writer, <i>Perth</i>	1828
690	Gardiner, John, <i>at Smithston</i>	1830
	Gardyne, Thomas, <i>of Middleton</i>	1836
	Garioch, John, <i>of Heathcote</i>	1826
	Gartshore, John Murray, <i>of Gartshore</i> , Capt. 42d or Royal Highlanders	1825
	Geddes, Adam G., <i>Airfield, Dalkeith</i>	1819
	Geekie, Alexander, <i>of Baldowie</i>	1837
	Gerard, John Mair, <i>of Midstrath</i>	1834
	Gibbon, Alexander, <i>of Johnston</i>	1834
	Gibbons, Edward, Factor to Macleod <i>of Macleod</i>	1830
	Gibson, Alexander, <i>of Glencrosh</i>	1835
700	Gibson, Alexander Carmichael, <i>younger of Castlecraig</i> ,	1836
	Gibson, John, W. S.	1825
	Gibson, John jun., W. S.	1828
	Gilchrist, Dugald, <i>of Ospisdale</i>	1817
	Gillespie, Alexander, Surgeon, <i>Edinburgh</i>	1806
	Gillespie, Alexander, Merchant, <i>Gould Square, London</i>	1836
	Gillespie, George, <i>of Biggar Park</i>	1829
	Gillespie, James, <i>of Parkhall</i>	1829
	Gillespie, Robert, Merchant, <i>London</i>	1829
	Gillespie, Thomas, <i>of Ardochy</i>	1821
710	Gillespie, William, <i>Gateside</i>	1829
	Gillon, William Doune, <i>of Wallhouse</i> , M. P.	1823
	Gilmour, Walter James Little, <i>of Craigmillar</i>	1828
	Gilzean, Thomas, <i>of Bunachton</i>	1813
	Girvan, Andrew, Accountant, <i>Edinburgh</i>	1831
	Gladstone, John, <i>of Fasque</i>	1833
	Gladstone, Thomas, <i>younger of Fasque</i> , M. P.	1834
	Glasford, James, <i>of Dugaldston</i> , Advocate	1806
	Goalen, Alexander, <i>of Leith</i>	1805
	Goldie, Alexander, W. S.	1822
720	Goldie, The Rev. Thomas S., <i>Coldstream</i>	1833
	Goodwin, Lieutenant-Col. Hugh Maxwell, <i>of Mount Alyn</i> , <i>Denbighshire</i>	1830
	Gordon, Lieut.-Col. Alex., late Sutherland Highlanders	1801

		Admitted
	Gordon, Captain Alexander, R. N.	1820
	Gordon, Alexander, <i>of Auchlunies</i>	1808
	Gordon, Alexander, <i>George Square, Edinburgh</i>	1817
	Gordon, Alexander, <i>Hillside Crescent</i>	1834
	Gordon, Charles, <i>of Auchluchries</i>	1832
	Gordon, Charles, <i>of Drimnin, Secretary of the Society</i>	1835
	Gordon, Captain Charles, R. N.	1835
730	Gordon, David, <i>of Abergeldie</i>	1822
	Gordon, Francis, <i>of Kincardine</i>	1835
	Gordon, George, <i>at Huntly</i>	1829
	Gordon, James, <i>of Culvenan</i>	1798
	Gordon, James, <i>of Manar</i>	1835
	Gordon, James Farquhar, <i>of Locharwoods, W. S.</i>	1804
	Gordon, James, <i>of Revack</i>	1813
	Gordon, James, <i>of Xeres de la Frontera</i>	1834
	Gordon, Colonel John, <i>of Cluny</i>	1807
	Gordon, John David, <i>of Wardhouse</i>	1828
740	Gordon, John, <i>of Cairnbulg, Advocate</i>	1811
	Gordon, John, <i>of Aikenhead</i>	1814
	Gordon, John, <i>of Corstoun</i>	1829
	Gordon, John, late Major of the 2d or Queen's Regiment	1822
	Gordon, John, <i>of Newton</i>	1834
	Gordon, John Taylor, <i>of Nethermuir, W. S.</i>	1831
	Gordon, Joseph, W. S.	1804
	Gordon, Lewis, retired Depute-Secretary of the Society	1799
	Gordon, Michael, <i>younger of Abergeldie</i>	1831
	Gordon, Peter Charles, <i>younger of Wardhouse</i>	1834
750	Gordon, Peter Laing, <i>of Craigmile</i>	1834
	Gordon, Robert, <i>of Jamaica</i>	1802
	Gordon, Robert, <i>Great King Street, Edinburgh</i>	1833
	Gordon, Thomas, <i>of Buthlaw</i>	1818
	Gordon, Lieutenant-Colonel Thomas, <i>of Park</i>	1825
	Gordon, William, <i>of Fyvie</i>	1834
	Gordon, Lieutenant-Col. W. A., late 50th Regiment, C. B.	1818
	Gordon, Capt. Wm., H. E. I. C. Service, <i>residing at Newton</i>	1828
	Gordon, William, <i>of Aberdour</i>	1834
	Govan, John, W. S.	1809
760	Gracie, John Black, W. S.	1834
	Græme, Robert, <i>of Garvock</i>	1824
	Graham, Major David, <i>of Meiklewood</i>	1831
	Graham, Frederick, Factor to the Duke of Athole	1821
	Graham, George, <i>late of Cassafuar</i>	1817

		Admitted
	Graham, George, <i>of Shaw</i>	1826
	Graham, Humphrey, W. S.	1819
	Graham, James, <i>of Leitchtown</i>	1827
	Graham, James Gillespie, <i>of Orchill</i>	1806
	Graham, John, <i>younger of Ballagan</i>	1823
770	Graham, John, <i>at Newbigging</i>	1829
	Graham, Patrick, <i>of Limekilns</i>	1836
	Graham, Robert, <i>of Redgorton, Advocate</i>	1817
	Graham, Robert, M. D., Professor of Botany in the University of Edinburgh	1821
	Graham, Robert, Merchant, <i>Leith</i>	1826
	Graham, William, <i>of Greigston</i>	1835
	Graham, William Stirling, <i>of Airth</i>	1833
	Graham, William, Writer, <i>Glasgow</i>	1828
	Graham, Lieut.-Colonel William, <i>of Mossknow</i>	1834
	Graham, William C. Cuninghame, <i>of Gartmore</i>	1796
780	Grainger, John, Factor to the Marquis of Lothian, <i>at Mounteviot</i>	1836
	Grant, Alexander, one of the Representatives in the Honourable House of Assembly, <i>Jamaica</i>	1810
	Grant, Alexander, <i>of Carnousie</i>	1835
	Grant, Captain Charles, Barrackmaster, <i>Nottingham</i>	1816
	Grant, David Macdowall, <i>of Arndilly</i>	
	Grant, Dugal, S. S. C., <i>York Place</i>	1833
	Grant, Duncan, <i>younger of Bught, W. S.</i>	1825
	Grant, Francis William, <i>younger of Grant</i>	1837
	Grant, Frederick, <i>of Mount Cyrus</i>	1832
	Grant, George Macpherson, <i>of Ballindalloch and Invereshie</i>	1806
790	Grant, James M., <i>of Glenmoriston and Moy</i>	1810
	Grant, James, <i>of Bught</i>	1813
	Grant, James, Principal Tacksman of Ruthven	1827
	Grant, Rev. James, First Minister of South Leith	1828
	Grant, John Peter, W. S.	1823
	Grant, John, <i>of Kilgraston</i>	1819
	Grant, John Macpherson, <i>younger of Ballindalloch and Invereshie</i>	1827
	Grant, Patrick, W. S. Sheriff-Clerk of Inverness-shire	1836
	Grant, Robert, <i>of Kincorth</i>	1826
	Grant, Robert, <i>of Tilliefour</i>	1830
800	Grant, William, <i>younger of Elchies</i>	1833
	Grant, William, <i>of Seabank</i>	1807
	Grant, W. P., <i>younger of Rothiemurchus</i>	1821
	Grassick, Charles, <i>residing at Buchaam</i>	1830

		Admitted
	Grassick, John, <i>Mains of Glenbucket</i>	1829
	Gray, Andrew Farquhar, of <i>Glentig</i> , Comptroller of the Customs, Aberdeen	1835
	Gray, John, Merchant, <i>Greenock</i>	1831
	Gray, Roderick, Factor at Peterhead for the Merchant Hospital, Edinburgh	1829
	Greenlaw, George, <i>Hilton</i>	1796
	Greenshields, John, of <i>Kerse</i>	1829
810	Gregorson, John, of <i>Ardtornish</i> , Sheriff-Substitute, <i>Mull</i>	1805
	Gregory, Arthur Thomas, of <i>Buchromb</i>	1833
	Greig, James, of <i>Eccles</i> , W. S.	1809
	Greig, James, at <i>Tullich</i>	1821
	Greig, John, of <i>Lethangie</i>	1833
	Grierson, William, of <i>Garroch</i> , W. S.	1828
	Grieve, William, of <i>Bransholm Park</i>	1834
	Gulland, William Erskine, of <i>Stripeside</i>	1833
	Gunn, George, Factor on the estate of Sutherland	1821
	Guthrie, John, of <i>Guthrie</i>	1836
820	Guthrie, John, younger of <i>Guthrie</i>	1836
	Guthrie, Major, <i>Cottage, Dundee</i>	1826
	Gwynne, Alban Thomas Jones, of <i>Monachty, Cardigan-shire</i>	1834

H

* HAMILTON & BRANDON, His Grace Alexander, Duke of, K. G.			1804
	HASTINGS, The Most Noble the Marquis of		1830
	HASTINGS, The Right Hon. Flora, Marchioness of		1805
†	HUNTLY, The Most Noble George, Marquis of, K. T.		1793
	HOME, The Right Hon. Alexander, Earl of		1832
†	HADDINGTON, The Right Hon. Thomas, Earl of		1804
	HOPETOUN, The Right Hon. John, Earl of		1826
830	HAY, The Right Hon. Lord John, Capt. R. N.		1824
	HALLYBURTON, The Right Hon. Lord Douglas Gordon, of <i>Pitcur</i> , M. P. for Forfarshire		1803
	HEPBURN, Sir Thomas Buchan, of <i>Smeaton Hepburn</i> , Bart.		1837
	HERRIES, The Right Hon. J. C., M. P.		1829
	HOPE, The Right Hon. Charles, Lord President of the Court of Session, and Lord Justice-General of Scotland		1793
	HOPE, Sir John, of <i>Craighall</i> , Bart.		1808
	HAY, Sir John, of <i>Park</i> , Advocate, Sheriff-Substitute of Stirlingshire		1834

		Admitted
	HAY, Sir John, of Smithfield and Hayston, Bart. M. P. for Peeblesshire	1811
	HALL, Sir John, of Dunglass, Bart.	1829
	HAY, Sir James Dalrymple, of Park Place, Bart.	1816
840	HONYMAN, Sir Richard B. Johnston, of Armadale, Bart.	1817
	HALLIDAY, Sir Andrew, M. D.	1806
	HUSSEY, Vice-Admiral Sir R. H., K. C. B., of Wood- <i>Walton, Huntingdonshire</i>	1827
	HAY, Colonel Sir A. Leith, M. P., younger of Rannes,	1819
	Hagart, Thomas, of Bantaskine	1826
	Hagart, William, Howard Place, Edinburgh	1804
	Haig, Alex. of Sunbury	1833
	Haig, William, of Dollarfield	1825
	Halket, Charles Craigie, of Hallhill	1834
	Hamilton, Alexander, of Grange, Advocate	1787
850	Hamilton, Alexander West, of Pinmore	1833
	Hamilton, Archibald, Rozelle, Captain H. E. I. C. S.	1833
	Hamilton, Dr James, of Corvour, Professor of Midwifery, University of Edinburgh	1817
	Hamilton, James, of Kames, W. S.	1807
	Hamilton, James, of Barns	1828
	Hamilton, John, of Sundrum	1804
	Hamilton, John Ferrier, of Westport	1827
	Hamilton, John, of Fairholm	1827
	Hamilton, Montgomery, Captain H. E. I. C. Naval Service	1836
	Hamilton, Lieut.-Col. R. Campbell, of Milburn and Dal- <i>serf</i>	1804
860	Hamilton, Robert William, Merchant, Leith	1814
	Hamilton, Thomas, Architect, Edinburgh	1826
	Hamilton, William, Merchant, Glasgow	1828
	Hamilton, William, of Craighlaw	1829
	Hart, Major Thomas, of Castlemilk	1805
	Harvey, Alexander, of Broadland	1811
	Harvey, Lieut.-Col. James Lee, of Castlesemple	1823
	Harvey, John Rae Lee, younger of Castlesemple	1836
	Harvey, John, of Ichwell, Bury, and Tiningly Park, <i>Yorkshire</i>	1809
	Hathorn, Hugh, of Castlewig	1825
870	Hathorn, Vans, of Garthland, W. S.	1802
	Hawes, Benjamin, of Old Barge Stairs, Blackfriars, <i>London</i>	1808
	Hawkins, James Whitshed, of Dunnichen, Advocate	1819
	Hay, Adam, Banker, Edinburgh	1825

		Admitted
	Hay, General Alexander, <i>of Rannes</i>	1812
	Hay, Alexander, <i>of Hardengreen</i> , W. S.	1837
	Hay, Charles, <i>of Ballindoch</i>	1825
	Hay, James, <i>of Belton</i>	1820
	Hay, James, Merchant, <i>Leith</i>	1828
	Hay, John, <i>of Letham</i>	1834
880	Hay, John Stewart, <i>of Coysfield</i>	1836
	Hay, Robert, <i>of Lawfield</i>	1807
	Hay, William, <i>of Laxfrith</i>	1828
	Hay, William, <i>of Dunse Castle</i>	1819
	Hay, William, <i>of Hopes</i>	1835
	Heathcoat, John, M. P. for Tiverton, Honorary Member	1837
	Hector, Alexander, Writer, <i>Edinburgh</i>	1824
	Henderson, Alexander, <i>Long Niddry</i>	1837
	Henderson, Captain David, <i>younger of Stemster</i>	1829
	Henderson, Duncan, M. D., 78th Regt.	1825
890	Henderson, John Alexander, <i>of Westerton</i> , 4th, or Queen's Own Light Dragoons	1831
	Henderson, John Irving, Advocate, Sheriff-Substitute, Dundee	1823
	Henderson, William, Merchant, <i>Edinburgh</i>	1811
	Henderson, William, retired Secretary British Linen Company	1823
	Henry, John, <i>of Corse</i>	1815
	Hepburn, John Stewart, <i>of Colquhalzie</i>	1810
	Herries, William Young, <i>of Spotts</i>	1823
	Heriot, John, <i>at Ladykirk</i>	1828
	Heriot, James, <i>of Ramornie</i> , W. S.	1800
	Heron, James, <i>of Dalmore</i>	1833
900	Hewatson, Robert, <i>of Auchenbenzie</i>	1834
	Hill, George Gosset, Merchant, <i>London</i>	1823
	Hill, Henry David, W. S.	1825
	Hill, Norman, <i>of Brownhills</i> , Advocate	1807
	Hill, Robert, <i>of Firth</i> , W. S.	1800
	Hog, James Maitland, <i>of Newliston</i>	1835
	Hood, John, <i>of Stoneridge</i>	1827
	Home, Francis, <i>younger of Cowdenknows</i>	1829
	Home, Colonel James, <i>of Broomhouse</i>	1829
	Home, Lieut.-Col. J. H. <i>of Bassendean</i> , Grenadier Guards	1834
910	Home, Dr James, <i>of Cowdenknows</i> , Professor of Physic in the University of Edinburgh	1799
	Home, John Forman, <i>of Wedderburn</i>	1830

		Admitted
	Home, William Forman, <i>of Billy and Paxton</i>	1823
	Hood, David, <i>of Balluderon</i>	1834
	Hope, Archibald, <i>younger of Craighall and Pinkie</i>	1832
	Hope, James, W. S.	1804
	Hope, John, Dean of the Faculty of Advocates	1823
	Hope, Dr Thomas Charles, Professor of Chemistry in the University of Edinburgh,	1804
	Horn, John, <i>of Thomanean</i>	1837
	Horne, Archibald, Accountant, <i>Edinburgh</i>	1828
920	Horne, Donald, <i>of Langwell, W. S.</i>	1817
	Horne, William, <i>of Scouthill</i> , Advocate, Sheriff of Had- dingtonshire	1813
	Horrocks, John, <i>of Tultichewen Castle</i>	1818
	Horsburgh, John, Factor to the Duke of Sutherland for the Estate of Reay	1829
	Horsburgh, Major William Henry	1824
	Hosier, James, <i>younger of Newlands</i> , Advocate	1822
	Houldsworth, Henry, <i>of Cranstonhill</i>	1836
	Houston, Ludovick, <i>of Johnston Castle</i>	1823
	Houston, Thomas, <i>of Creech</i>	1821
	Houston, Lieut.-Col. <i>of Clerkington</i>	1833
930	Howard, Lieut.-Col. <i>late North British Staff</i>	1809
	Howden, James, Jeweller, <i>Edinburgh</i>	1827
	Hunt, James, <i>of Pittencrief and Logie</i>	1816
	Hunt, William, <i>younger of Pittencrief and Logie</i>	1836
	Hunter, Alexander, W. S.	1824
	Hunter, Andrew, <i>of Bonnington</i>	1819
	Hunter, Charles, <i>residing at Templehall</i>	1826
	Hunter, Charles, <i>of Seaside and Glencarse</i>	1823
	Hunter, David, <i>of Blackness</i>	1826
	Hunter, James, <i>of Thurston</i>	1812
940	Hunter, James, <i>of Templehall</i>	1823
	Hunter, Capt. James, <i>of Auchterarder</i>	1823
	Hunter, James, <i>of Hafton</i>	1833
	Hunter, John, Wine Merchant, <i>Leith</i>	1833
	Hunter, John, <i>at Ardrossan</i>	1836
	Hunter, John, <i>younger of Bonington</i>	1836
	Hunter, Richard, late Bengal Civil Service	1837
	Hunter, William Hugh, <i>Perth</i>	1836
	Hunter, William, <i>of Ormiston</i>	1812
	Hutchison, Hugh, <i>of Southfield</i>	1812
950	Hutchison, Robert, <i>younger of Cairngall</i>	1829
	Hutchison, Thomas, <i>Mains of Timwald</i>	1830

I

	IRVINE, Sir Paulus Emilius, Bart.	1831
	Inglis, James P., late Merchant, <i>Leith</i>	1806
	Inglis, John, of <i>Redhall</i>	1825
	Innes, James Rose, of <i>Netherdale</i>	1827
	Innes, Lewis, of <i>Balnacraig</i>	1834
	Innes, Robert, younger of <i>Thrumster</i>	1824
	Innes, William, of <i>Raemoir</i>	1834
	Irvine, Alexander Forbes, of <i>Chivas</i>	1805
960	Irvine, Patrick, of <i>Inveramsay</i> , W. S.	1827
	Ivory, James, Advocate, Sheriff of Buteshire	1833
	Izett, Chalmers, formerly of <i>Kinnaird</i>	1808

J

	JARDINE, Sir William, of <i>Applegirth</i> , Bart.	1823
	JARDINE, Sir Henry, of <i>Harwood</i> , Knight, King's Remembrancer of Exchequer	1799
	Jameson, Robert, Prof. of Mineralogy and Natural History in the University of Edinburgh	1820
	Jardine, James, Civil-Engineer, <i>Edinburgh</i>	1818
	Jardine, John, Advocate, Sheriff of Ross and Cromarty	1833
	Jardine, Thomas, <i>Moffat</i>	1829
	Jerdan, Archibald, of <i>Bonjedward</i>	1831
970	Jerdan, George, Secretary Union Agricultural Society	1832
	Johnston, George, Factor to the Earl of Eglinton	1822
	Johnston, Alexander, W. S.	1819
	Johnston, Alexander, W. S. <i>Aberdeen</i>	1836
	Johnston, George, jun. <i>Edinburgh</i>	1828
	Johnston, Henry, Surgeon, <i>Edinburgh</i>	1798
	Johnston, James, of <i>Straiton</i>	1823
	Johnston, James, of <i>Alva</i>	1828
	Johnston, James, <i>Tibbermalloch</i>	1836
	Johnston, John James Hope, of <i>Annandale</i> , M. P. for Dumfriesshire	1824
980	Johnstone, John, Land-surveyor	1806
	Johnston, John, Factor for the Earl of Glasgow	1833
	Johnstone, Peter, of <i>Carnsalloch</i>	1803
	Johnston, Robert, Merchant, <i>Edinburgh</i>	1813
	Johnston, Captain Charles, of <i>Cowhill</i> , R. N.	1830
	Johnstone, Thomas, of <i>Underwood</i> , S. S. C.	1812
	Johnstone, Walter, of <i>Chapplegill</i>	1829
	Johnstone, William, Banker, <i>Girvan</i>	1833
	Johnstone, William, Merchant, <i>Greenock</i>	1825

		Admitted
	Jollie, Walter, W. S.	1829
990	Jolly, David Leitch, <i>Grange of Elcho</i>	1829
	Jolly, Stewart, Chamberlain to the Duke of Montrose	1827
	Jopling, Thomas, <i>Coldstream</i>	1823
	Jopp, Alexander, Advocate, <i>Aberdeen</i>	1834
K		
	† KINNOUL, The Right Honourable Thomas, Earl of	1806
	KINTORE, The Right Honourable Anthony, Earl of	1826
	KENMURE, The Right Honourable John, Viscount	1828
	KELBURNE, The Right Honourable James, Viscount	1822
	KINNAIRD, The Right Honourable George William, Lord	1830
	KERR, The Right Honourable Lord Robert,	1808
1000	KINLOCH, Sir David, <i>of Gilmerton</i> , Bart.	1828
	KEIR, Major-General Sir William Grant	1804
	Keay, James, <i>of Snaigo</i> , Advocate	1806
	Keir, John, <i>of Westfield</i>	1832
	Keir, Patrick Small, <i>of Kinmonth</i> , Advocate	1805
	Keir, Patrick Small, <i>younger of Kinmonth</i> , Advocate	1837
	Keith, William, Accountant <i>in Edinburgh</i>	1821
	Kennedy, Hugh Ferguson, <i>of Bennan and Finnarts</i>	1832
	Kennedy, John, <i>of Milton Park, Ardwick House, Manchester</i>	1830
	Kennedy, John, <i>younger of Underwood</i> , W. S.	1836
1010	Kennedy, Quintin, <i>of Drumellan</i>	1834
	Kennedy, Robert, <i>of Westertown</i> , W. S.	1837
	Kennedy, Robert Thomson, <i>of Daljarroch</i>	1833
	Kennedy, T. F. <i>of Dunure</i>	1812
	Ker, James, <i>of Blackshiels</i>	1825
	Kerr, Captain James, <i>of Grange and Carskerdo</i>	1836
	Kerr, John, <i>of Kerfield</i> , W. S.	1805
	Kerr, Robert, Surgeon, <i>Portobello</i>	1816
	Kerr, William, retired Secretary General Post-Office	1789
	Kerr, William Scott, <i>of Chatto</i>	1833
1020	Kidd, Alexander, Writer, <i>Edinburgh</i>	1824
	Kilgour, Robert, jun. <i>of Millbank</i>	1826
	Kincaid, John Lennox, <i>of Kincaid</i>	1824
	Kinloch, George, <i>of Kinloch</i>	1825
	Kinloch, John, <i>of Kilrie</i> , Lieutenant 2d Life Guards	1829
	Kinnear, Charles, <i>of Kinnear</i>	1824
	Kinnear, Patrick, <i>younger of Lochton</i>	1823
	Knight, George William Henry, <i>of Jordanstown</i> , Capt. R.N.	1833
	Knight, George, <i>younger of Jordanstown</i>	1833
	Kyle, Captain Alexander, <i>of Binghill</i>	1835

L

1030	†	LOTHIAN, The Most Noble John William, Marquis of	1821
		LANSDOWNE, The Most Noble Henry, Marquis of, K. G.	
		Honorary Member	1837
		LAUDERDALE, The Right Hon. James, Earl of, K. T.	1789
	†	LEVEN and MELVILLE, Right Hon. David, Earl of	1820
		LYNEDOCH, the Right Hon. Gen. Thomas, Lord, G. C. B.	1803
		LOVAT, the Right Hon. Thomas Alexander, Lord	1820
		LIVINGSTONE, Sir Thomas, <i>of West Quarter</i> , Bart.	1815
		LAWRIE, Sir Robert, <i>of Maxwelltown</i> , Bart.	1828
		LAUDER, Sir Thomas Dick, <i>of Fountainhall</i> , Bart.	1827
		LEITH, Major-General Sir George, Bart.	1833
1040		LAMB, Sir Charles, <i>of Beauport</i> , Bart.	1836
		LOCKHART, Sir Norman Macdonald, <i>of Lee and Carnwath</i> , Bart.	1832
		LEES, Sir Edward S., Secretary to the General Post-Office for Scotland	1832
		LEITH, Major-General Sir Alexander, <i>of Freefield</i> K. C. B.	1811
		LIMOND, Colonel Sir James, late Madras Artillery	1828
		L'Amy, James, <i>of Dunkenny</i> , Sheriff of Forfarshire	1806
		Laidlaw, Robert, <i>at Nethercosrock</i>	1833
		Laing, Rev. Francis, <i>of Carselogie</i>	1824
		Laird, David, <i>of Strathmartin</i>	1833
		Lamond, James, <i>of Stranduff</i>	1827
1050		Lamond, Peter, Brewer, <i>Edinburgh</i>	1820
		Lamont, Alexander, <i>of Knockdow</i> , W. S.	1819
		Lamont, James, Lieut. R. N.	1824
		Lang, Alexander, <i>of Overton</i>	1801
		Laurie, Robert, Merchant, <i>Leith</i>	1834
		Laurie, Thomas, Land Valuator, <i>Edinburgh</i>	1829
		Laurie, William Kennedy, <i>of Woodhall</i>	1827
		Lawson, Charles, <i>Nursery and Seedsman to the Society</i>	1830
		Lawson, John, <i>younger of Chappelton</i>	1832
		Learmonth, John, Merchant, <i>Edinburgh</i>	1814
1060		Learmonth, Thomas, <i>of Lawrence Park</i>	1824
		Legh, Rev. Peter, <i>Golborne Park, Lancashire</i>	1823
		Leighton, William, Manager of the Duke of Hamilton's Coalworks	1831
		Leitch, James, Merchant, <i>Greenock</i>	1831
		Lennie, William, <i>of Ballochneck</i>	1836
		Lennox, James, <i>of Dalskairth</i>	1830
		Leslie, Angus, <i>Prinsinain</i>	1830
		Leslie, George, <i>of Rothie</i>	1826

		Admitted
	Leslie, H. G. <i>of Dunlugas</i>	1826
	Leslie, William, <i>of Warthill</i>	1826
1070	Leny, James Macalpine, <i>of Dalswinton</i>	1824
	Limond, David, <i>of Dalblair</i>	1832
	Lindsay, Lieut.-Col. James, <i>of Balcarras</i>	1823
	Lindsay, John, Corn-merchant, <i>Dundee</i>	1826
	Lindsay, Patrick, Wine-merchant, <i>Leith</i>	1823
	Lindsay, Lieutenant-Colonel Martin, 78th Regiment	1816
	Linning, Michael, W. S.	1804
	Lizars, William Henry, <i>Regent Terrace, Edinburgh</i>	1835
	Loch, James, M. P.	1822
	Loch, William, <i>of Rachan</i>	1824
1080	Lockhart, Alexander Macdonald, <i>Carmath House,</i>	1835
	Lockhart, Allan, Elliot, <i>of Borthwickbrae</i>	1832
	Lockhart, Norman, <i>of Tarbrax, W. S.</i>	1815
	Lockhart, William, <i>of Millton Lockhart</i>	1836
	Logan, Alexander, <i>London</i>	1831
	Longmore, John Alexander, W. S.	1837
	Lorimer, James, <i>of Keltyfield</i> , Factor to the Right Honour- able the Earl of Kinnoul	1826
	Lorraine, Lieut.-Col. A., Dep.-Gov. South Sea Castle	1827
	Lothian, Edward, Advocate	1805
	Louson, David, Town-Clerk of <i>Arbroath</i>	1813
1090	Low, Alexander, Accountant, <i>Edinburgh</i>	1830
	Low, David, <i>of Laws</i> , Professor of Agriculture in the Uni- versity of Edinburgh	1825
	Lumsdaine, The Reverend Edwin Sandys, <i>of Blanerne</i> <i>and Invergelly</i>	1837
	Lumsdaine, James, <i>of Lathallan</i>	1833
	Lumsden, Benjamin, <i>of Kingsford</i>	1828
	Lumsden, Harry Leith, <i>of Auchindoir</i>	1822
	Lumsden, Henry, <i>of Tilwhilly</i>	1830
	Lumsden, Hugh, <i>of Pitcaple</i> , Advocate, Sheriff of Suther- landshire	1825
	Lyall, Robert, Factor to Sir J. Carnegie of Southesk, Bart.	1826
	Lyell, Thomas, R. N., <i>Kinnordy</i>	1836
1100	Lyon, George, <i>of Glenogle</i>	1809
	Lyon, John, High School, <i>Leith</i>	1824

M

MONTROSE, His Grace James, Duke of	1821
MONTROSE, Her Grace Jemima, Duchess Dowager of	1834
† MORTON, The Right Honourable George Sholto, Earl of	1828

	† MORAY, The Right Honourable Francis, Earl of, K. T.	1793
	† MANSFIELD, The Right Honourable William, Earl of, K. T.	1803
	MINTO, The Right Honourable Gilbert, Earl of, G. C. B.	1808
	† MELVILLE, The Right Honourable Robert, Viscount, K. T.	1798
	MACDONALD, The Right Honourable Godfrey William Wentworth, Lord	1833
1110	MONTAGUE, The Right Honourable Henry James, Lord	1801
	MURRAY, Lieutenant-General the Right Honourable Sir George, G. C. B.	1826
	MAITLAND, Captain the Honourable Anthony, R. N.	1831
	MAULE, The Honourable Fox, <i>younger of Panmure</i> , M. P. for Perthshire	1831
	MACDONALD, Honourable Archibald	1796
	MACDONALD, Honourable Dudley	1803
	MACKENZIE, The Honourable Mrs Stewart <i>of Seaforth</i>	1816
	MEADOWBANK, The Honourable Lord	1800
	MACKENZIE, The Honourable Lord	1803
	MEDWYN, The Honourable Lord	1802
1120	MONCREIFF, The Honourable Lord	1830
	MAITLAND, Lieutenant-General the Hon. W. Mordaunt	1827
	MELVILLE, The Honourable William Leslie	1833
	MURRAY, The Hon. George, <i>of Glenlyon</i>	1834
	MURRAY, The Honourable James, Advocate	1832
	MACKENZIE, The Right Hon. Holt	1833
	MAXWELL, General Sir William, <i>of Calderwood</i> , Bart.	1804
	MENZIES, Sir Neil, <i>of Menzies</i> , Bart.	1802
	MURRAY, the Honourable Sir Patrick, <i>of Ochertyre</i> , Bart.	1793
	MACKENZIE, Sir George S. <i>of Coul</i> , Bart.	1801
1130	MAXWELL, Major-Gen. Sir Wm. <i>of Monreith</i> , Bart.	1803
	MAXWELL, Sir John, <i>of Pollock</i> , Bart.	1798
	MAXWELL, Sir Patrick, <i>of Springkell</i> , Bart.	1830
	MACKENZIE, Sir Francis Alexander, <i>of Gairloch</i> , Bart.	1824
	MACKENZIE, Sir James Wemyss, <i>of Scatwell</i> , Bart.	1817
	MONTGOMERY, Sir George, <i>of Macbiehill</i> , Bart.	1805
	MACGREGOR, Sir Evan Murray, <i>of Macgregor</i> , Bart.	1801
	MONTGOMERY, Sir James, <i>of Stanhope</i> , Bart.	1801
	MAXWELL, Sir David, <i>of Cardoness</i> , Bart.	1810
	MACKENZIE, Sir John W. P. M., <i>of Delvin</i> , Bart.	1829
1140	MACKENZIE, Sir Colin, <i>of Kilcoy</i> , Bart.	1801
	MILNE, Admiral Sir David, K. C. B.	1808
	MACLEOD, Major-General Sir John, <i>of Unish</i> ,	1804
	Macadam, John, <i>of Blairover</i> ,	1824

		Admitted
	Macalister, Charles S., <i>of Kennox</i>	1806
	Macalister, Major James, <i>of Springbank</i> , late 13th Dragoons	1807
	Macalister, Keith Macdonald, <i>of Inistrynish</i>	1829
	Macallan, James, W. S.	1823
	Macan, Captain John, <i>of Lurgyvallon</i>	1833
	Macarthur, Dr Peter, <i>of Delnies</i>	1819
1150	Macartney, Alexander, retired Manager Commercial Banking Co.	1823
	Macbean, Æneas, W. S.	1812
	Macbean, Duncan, <i>of Tomatin</i> , Merchant, <i>Glasgow</i>	1828
	Macbean, Lieutenant-Colonel James, late 78th Regiment	1806
	Macbraire, John Joseph, <i>of Tweedhill and Broadmeadows</i>	1832
	Macaskill, Hugh, <i>of Tallisker</i>	1830
	Maccheyne, Adam, W. S.	1819
	Maccorquodale, Hugh, Merchant, <i>Liverpool</i>	1803
	Macrummen, Captain John, 11th Regiment of Foot	1821
	Macculloch, John, <i>of Barholm</i>	1810
1160	Maediarmid, John, <i>Dumfries</i>	1827
	Macdonald, Alexander, <i>of Lochsheil</i>	1824
	Macdonald, Major-General Alexander, Royal Horse Artillery	1810
	Macdonald, Captain Angus, <i>of Milltown</i>	1798
	Macdonald, Angus, <i>of Glenaladale</i>	1827
	Macdonald, Lieut.-Col. D. Robertson, <i>of Kinlochmoidart</i>	1805
	Macdonald, Major Donald, <i>of Ardmore</i>	1822
	Macdonald, Captain Donald, Royal Engineers	1817
	Macdonald, Donald, <i>of Craighuie</i>	1829
	Macdonald, Donald, <i>of Lochinver</i>	1834
1170	Macdonald, Hugh, <i>of Boisdale</i>	1820
	Macdonald, Hugh P., <i>of Mougstad</i>	1830
	Macdonald, James, <i>of Dalness</i> , Advocate	1822
	Macdonald, James Thomas, <i>of Balranald</i>	1832
	Macdonald, Captain John, <i>of Springfield</i>	1797
	Macdonald, Lieut.-Colonel John, <i>of Kingsburgh</i>	1797
	Macdonald, Colonel John, <i>of Dalchoisnie</i> , 92d Regiment	1819
	Macdonald, John, Procurator-Fiscal, <i>Dunfermline</i>	1836
	Macdonald, Matthew N. W. S.	1818
	Macdonald, Norman, <i>of Barnisdale</i>	1789
1180	Macdonald, Norman, <i>younger of Barnisdale</i>	1834
	Macdonald, Major Ranald, late 92d Regiment	1823
	Macdonald, Ranald, <i>of Bornish</i>	1806
	Macdonald, Reginald George, <i>of Clanranald</i>	1807

	Macdonald, Lieut.-Col. Robert, Royal Horse Artillery, C.B.	1814
	Macdonald, Thomas, <i>Fort William</i>	1827
	Macdonald, William, <i>of St Martin's</i>	1802
	Macdonald, Lieut.-Colonel William, <i>of Calley</i>	1813
	Macdonald, William, <i>of Ballyshare</i>	1818
	Macdonell, Alexander, W. S. and Sheriff-substitute of Wigtonshire	1832
1190	Macdonell, Lieut.-Colonel George, <i>Edinburgh</i>	1833
	Macdonell, Major-General James, Coldstream Guards	1803
	Macdonell, James, <i>of Milnfield</i> , W. S.	1812
	Macdonell, Captain John, <i>Killyhonet, Fort William</i>	1821
	Macdoul, Lieutenant-Colonel, C. B. <i>Stranraer</i>	1824
	Macdougall, Allan, W. S.	1829
	Macdougall, Colin, <i>of Lunga</i>	1808
	Macdougall, Dugald, <i>of Gallanich</i>	1814
	Macdougall, Major Patrick, <i>of Soroba</i>	1800
	Macdougall, Alexander, Solicitor, <i>London</i>	1836
1200	Macdougall, John, <i>of Macdougall</i> , Captain R. N.	1821
	Macdowal, William, <i>of Woolmet</i>	1810
	Macduff, Alexander, <i>of Bonhard</i>	1811
	Maceachern, Captain Colin, <i>of Outfield</i>	1825
	Macewan, James, <i>of Grenada</i>	1834
	Macfarlane, Alexander, <i>of Thornhill</i>	1825
	Macfarlane, John, <i>of Muckroy</i>	1821
	Macfarlane, John Fletcher, Surgeon, <i>Edinburgh</i>	1823
	Macfarlane, Thomas, <i>Strachurmore</i>	1829
	Macfarlane, William Dick, <i>of Dunavour</i> , 42d or Royal Highlanders	1831
1210	Macfarlane, Wm., <i>of Carse of Boquhapple</i> , late 17th Lancers	1832
	Macfie, John, Merchant, <i>Leith</i>	1823
	Macfie, William, <i>younger of Langhouse</i> , Merchant, <i>Greenock</i>	1826
	Macgibbon, Alexander, <i>of Crawhill</i>	1835
	Macgillivray, Simon, Merchant, <i>London</i>	1821
	Macgillivray, William, <i>Jamaica</i>	1817
	Mackgill, David Maitland, <i>of Rankeillour</i>	1826
	Macgounie, Robert, <i>of Mains</i>	1824
	Macgregor, Alexander, jun. <i>Glasgow</i>	1823
	Macgregor, Major Hugh, late 91st Regiment	1814
1220	Macgregor, James, <i>of Fonab</i>	1822
	Macgregor, James, <i>Fort-William</i>	1833
	Macgregor, John Atholl Bannatyne, <i>younger of Macgregor</i>	1832
	Macgregor, John, <i>of Glengyle</i>	1832
	Macgregor, Major-General Murray, Bengal Cavalry	1801

		Admitted
	Macilwraith, James, of Auchinflower	1835
	Macinnes, James, S. S. C.	1812
	Macinnes, John, at Dandaleith	1822
	Macinnes, John, of Auchinfroe and Woodburn	1830
	Macinroy, James Patrick, of Lude	1831
1230	Macinroy, William, of Shierglas	1827
	Macintosh, Alexander, of Macintosh	1833
	Macintosh, George, younger of Geddes and Hilton	1832
	Macintosh, Lieut.-Colonel J. J., of Far, Madras Artillery	1823
	Macintosh, William, of Geddes and Hilton	1816
	Macintosh, William, of Millbank	1813
	Macintosh, Donald, Edinburgh	1816
	Macintosh, Lachlan, of Raigmore	1814
	Macintyre, Donald, late of Pitnacree	1803
	Macintyre, Donald, Writer, Glasgow	1818
1240	Macivor, John, of Ardarnock	1827
	Mackay, Lieut.-Colonel Colin Campbell, of Bighouse	1808
	Mackay, James, Goldsmith, Edinburgh, the Society's Jeweller and Medalist	1804
	Mackay, John, Banker, Inverness	1837
	Mackay, Kenneth, of Torboll	1805
	Mackean, John, Manager of the Scot. Life Assur. Comp.	1822
	Mackellar, Reverend Angus, Minister of Pencaitland	1818
	Mackellar, Duncan, Merchant, Glasgow	1809
	Mackenzie, Alexander, of Woodside	1802
	Mackenzie, Alexander, Sheriff-substitute of Ross-shire	1805
1250	Mackenzie, Alexander, Writer, Perth	1829
	Mackenzie, Major Forbes, of Fodderty	1829
	Mackenzie, George Falconer, of Allangrange	1819
	Mackenzie, George Ross, of Aldie	1819
	Mackenzie, George, Dingwall	1830
	Mackenzie, James William, of Pittrichie	1825
	Mackenzie, John, younger of Glack	1835
	Mackenzie, John, Agent at Inverness for the Bank of Scotland	1809
	Mackenzie, John, Writer, Edinburgh	1813
	Mackenzie, John, Tain	1835
1260	Mackenzie, John Hay, of Cromartie	1822
	Mackenzie, John Whiteford, W. S.	1821
	Mackenzie, J. A. Stewart, of Seaforth, M.P. for Ross-shire	1803
	Mackenzie, Kenneth Francis, formerly of Park Place, Edinburgh	1811
	Mackenzie, Murdo, of Ardross	1799

	Mackenzie, Richard, <i>of Dolphington</i> , W. S. Depute-Keeper of the Signet	1809
	Mackenzie, Roderick, <i>of Glack</i>	1790
	Mackenzie, Sutherland, Manager of the Scottish Union Insurance Company	1808
	Mackenzie, Thomas, <i>of Applecross</i>	1816
	Mackenzie, Dr William, <i>Edinburgh</i>	1801
1270	Mackenzie, William, <i>of Muirton</i> , W. S.	1803
	Mackenzie, William Forbes, <i>of Portmore</i> , Advocate	1831
	Mackilligan, William, <i>of Relugas</i>	1837
	Mackinlay, John, <i>of Rothesay</i>	1818
	Mackinnon, Alexander Kenneth, <i>of Skalisraig</i>	1827
	Mackinnon, Dr Farquhar, <i>of Kyle</i>	1819
	Mackinnon, Rev. John, Minister of Slate	1815
	Mackinnon, Neil, <i>of Demerara</i>	1819
	Mackinnon, William Alexander, <i>of Mackinnon</i>	1811
	Macintosh, Charles, <i>of Aberarder</i>	1831
280	Maclachlan, Colin, <i>Laudle</i> ;	1836
	Maclachlan, Donald, <i>of Scurrybreck</i>	1831
	Maclachlan, Dugald, one of the Sheriff-substitutes of Inver- ness-shire	1832
	Maclachlan, Eun, <i>Liddesdale</i>	1836
	Maclachlan, Robert, <i>of Maclachlan</i>	1817
	Maclaine, John, <i>of Killundine</i>	1822
	Maclaine, Major Lachlan, 1st Royal Regiment	1836
	Maclaine, Murdoch, <i>of Lochbuy</i>	1811
	Maclaine, Murdoch, <i>younger of Lochbuy</i>	1835
	Maclarty, Colin, <i>late of Jamaica</i>	1808
1290	Maclaren, Charles, <i>Edinburgh</i>	1833
	Maclaren, Donald, Agent for the Leith Banking Company <i>at Callander</i>	1832
	Maclaren, Duncan, <i>Cambuserricht</i>	1834
	Maclaren, James, <i>Gavel House, Kilsyth</i>	1832
	Maclaurin, Malcolm, <i>Oban</i>	1803
	Maclean, Colonel Alexander, <i>of Ardgower</i>	1793
	Maclean, Alexander, <i>of Carsaig</i>	1835
	Maclean, Lieutenant-Colonel Allan Thomas, 13th Light Dragoons	1835
	Maclean, Archibald D., Navy Pay-Office, <i>London</i>	1837
	Maclean, Donald, <i>of Borera</i>	1822
1300	Maclean, Donald, W. S.	1793
	Maclean, Hugh, <i>of Coll</i>	1819
	Maclean, Hugh, <i>late of Jamaica</i>	1827

		Admitted
	Maclean, Dr Lachlan, Principal Tacksman of Rum	1823
	Maclean, Lachlan, Merchant, <i>Glasgow</i>	1837
	Maclean, Neil, Land-Surveyor, <i>Inverness</i>	1837
	Macleish, Adam, Merchant, <i>Greenock</i>	1831
	Maclelland, Thomas, Banker, <i>Ayr</i>	1836
	Macleod, Alexander, Surgeon, <i>Uist</i>	1829
	Macleod, Alexander, <i>of Canada</i>	1811
1310	Macleod, Alexander Norman, <i>late of Harris</i>	1817
	Macleod, Alexander, <i>formerly of Muiravonside</i>	1800
	Macleod, Donald, <i>of Talisker</i>	1800
	Macleod, Donald, <i>at Claggan</i>	1830
	Macleod, Æneas R. B., <i>of Cadboll</i>	1786
	Macleod, Captain Neill, <i>Gesto</i>	1799
	Macleod, Mrs, <i>of Macleod</i>	1816
	Macleod, Martin, <i>Drynoch</i>	1831
	Macleod, Roderick, <i>younger of Cadboll</i> , M.P. for Sutherlandshire	1807
	Macleod, Colonel Wm. Hon. East India Co.'s Service	1817
1320	Macleod, William, <i>of Orbst</i>	1831
	Maclellan, John, Merchant, <i>Greenock</i>	1831
	Macmillan, Donald, <i>of Lephenstrath</i>	1825
	Macmillan, Captain Iver, late of the Valentine Indiaman	1798
	Macmillan, James, <i>of Lawloch</i>	1834
	Macmillan, Michael, Merchant, <i>Glasgow</i>	1810
	Macmillan, Thomas, <i>of Shorthope</i> , W. S.	1817
	Macnab, Archibald, <i>of Macnab</i>	1806
	Macnab, Gilbert, Sheriff-clerk Depute, <i>Ayr</i>	1836
	Macnabb, James Munro, <i>Arthurstone</i>	1837
1330	Macneale, George, <i>of Ugadale</i>	1825
	Macneill, Captain Alexander, <i>younger of Colonsay</i>	1835
	Macneill, Lieutenant-Colonel Donald, late 91st Regiment	1802
	Macneill, Duncan, Advocate	1833
	Macneill, John, <i>late of Oakfield</i>	1796
	Macneill, Lachlan, <i>of Drumdrissaig</i>	1833
	Macneill, Colonel Roderick, <i>of Barra</i>	1817
	Macneill, Alexander, Collector of Customs, <i>Stranraer</i>	1829
	Macneill, Alexander, Advocate	1835
	Macneill, Malcolm, <i>Lossit, Islay</i>	1835
1340	Macnicol, John, Factor to the Earl of Airlie	1831
	Macnicol, Nicol, <i>Glenbranter</i> , Lt. Half-pay, H.M. 27th Regt.	1836
	Macnight, Colonel Patrick, <i>of Barns</i>	1836
	Macpherson, Allen, 2 <i>Harley Place, New Road, London</i>	1822
	Macpherson, Allen, <i>Kingussie</i>	1821

		Admitted
	Macpherson, Major-General Duncan, Hon. E. I. C. S.	1825
	Macpherson, Major Evan, <i>of Glentrium</i> , Hon. E. I. C. S.	1832
	Macpherson, Ewen, <i>of Cluny Macpherson</i>	1827
	Macpherson, Hugh, <i>of Eigg</i> , M. D. one of the Professors of King's College, Aberdeen	1828
	Macpherson, John, Factor for Lovat	1809
1350	Macpherson, Kenneth, late Member of the Hon. House of Assembly, Jamaica	1826
	Macpherson, William, <i>of Blairgowrie</i>	1822
	Macquarrie, Lachlan, <i>of Jarvisfield</i> , Scots Greys	1835
	Macqueen, Captain Simon, <i>Corrybrough</i>	1820
	Macrae, Alexander, <i>of Ashkernish</i>	1832
	Macrae, Colin, <i>of Demerara</i>	1823
	Macritchie, Charles Elder, <i>Edinburgh</i>	1831
	Macritchie, Thomas, Merchant, <i>Leith</i>	1805
	Macritchie, Thomas Elder, <i>of Craigton</i> , W. S.	1831
	Mactaggart, Captain J. O., late Hon. East India Company's Maritime Service	1835
1360	Mactier, Anthony, <i>of Durris</i>	1834
	Macturk, Robert, <i>younger of Stenhouse</i>	1826
	Macvicar, Rev. J. G., Lecturer on Natural History in the University of St Andrew's	1828
	Maitland, Adam, <i>of Dundrenan</i>	1802
	Maitland, William, <i>of Auchlane, Gilston Castle</i>	1825
	Malcolm, Neill, <i>of Pollalloch</i>	1830
	Mansfield, John, <i>of Midmar</i>	1827
	Mansfield, Thomas, Accountant, <i>Edinburgh</i>	1827
	Marshall, Claud, Sheriff-Substitute of Greenock	1819
	Marshall, David, <i>of Neilsland</i>	1828
1370	Marshall, Henry, Dep. Inspector-General of Hospitals	1833
	Marshall, James, Jeweller, <i>Edinburgh</i>	1833
	Marshall, John, Advocate	1822
	Massie, W. W., Hon. East India Comp. Civil Service	1816
	Masterton, James, <i>of Braco</i>	1824
	Maule, William, <i>Dublin Street, Edinburgh</i>	1830
	Maxton, John, Wine Merchant, <i>Leith</i>	1835
	Maxtone, Anthony, <i>of Cultoquhey</i>	1812
	Maxwell, Alexander Harley, <i>of Portrack</i>	1834
	Maxwell, Henry, 2d son of Sir William Maxwell, <i>of Cal- derwood</i> , Bart.	1830
1380	Maxwell, John, <i>younger of Pollock</i> , M.P. for Lanarkshire	1825
	Maxwell, John Argyll, <i>residing at Aros</i>	1834
	Maxwell, John Herries, <i>of Munches</i>	1826

		Admitted
	Maxwell, Lieut.-Col., of Orchardtown and Gretna	1825
	Maxwell, Marmaduke Constable, of Terregles	1830
	Maxwell, W. A., younger of Calderwood, Major 1st or King's Dragoon Guards	1830
	Maxwell, William Constable, of Nithsdale and Evringham	1830
	May, John, of Bradfield, Merchant, Glasgow	1827
	Mayne, Colonel John, Hon. E. India Comp. Service, C. B.	1831
	Meason, Magnus Gilbert Laing, of Lindertis	1836
1390	Meek, George, of Campfield	1814
	Megget, Thomas, W. S.	1811
	Meikle, George, Surgeon Hon. E. I. C. S.	1833
	Meiklam, James, of Cairnbroe	1831
	Meiklejohn, James, Alloa	1833
	Mein, William, of Ormiston	1832
	Melville, John Whyte, of Mount Melville	1819
	Menteath, Charles Granville Stuart, of Closeburn Hall	1803
	Menteath, James Stuart, younger of Closeburn Hall	1837
	Menzies, Major Archibald, late of the 42d Regiment	1817
1400	Menzies, George Cumming, of Knockintobar	1837
	Menzies, James, of Pitnacree	1834
	Menzies, John, of Pitfodels	1806
	Menzies, John, of Chesthill	1821
	Menzies, Joseph Stewart, of Foss	1803
	Menzies, Robert, W. S., Depute-Clerk of Session	1798
	Menzies, Robert, Land-surveyor, Aberfeldy	1829
	Mercer, George, of Gorthy	1822
	Mercer, Græme, of Mavisbank	1819
	Mill, George, of Blair	1826
1410	Mill, John, Merchant, Edinburgh	1814
	Milne, David, younger of Milnegraden, Advocate	1835
	Milne, John, Merchant, Grangemouth	
	Millar, Andrew, Merchant, Edinburgh	1827
	Miller, Charles Hagart, of Pleasanthill, W. S.	1834
	Miller, George, of Frankfield	1814
	Miller, John, of Ballumbie	1834
	Miller, Lieut.-Colonel, of Urquhart	1834
	Miller, Thomas Hamilton, Advocate, Sheriff of Selkirkshire	1804
	Miller, Patrick, Dalswinton	1806
1420	Miller, William, of Monkcastle, Advocate	1828
	Mitchell, Colonel James, late of the 92d Regiment	1821
	Mitchell, John, jun., Merchant, Leith	1832
	Mitchell, John, of Bellfield	1836

		Admitted
	Mitchell, Joseph, Civil-Engineer, and Superintendent of the Parliamentary Roads in Scotland	1836
	Mitchell, Patrick, <i>residing at Enzean, Monymusk</i>	1831
	Mitchell, William, <i>of Gordonhall</i>	1821
	Mitchell, William, <i>of Parson's Green</i>	1819
	Mitchelson, Arch. Hepburne, <i>of Middleton</i>	1832
	Molle, William, W. S.	1802
1430	Moore, James Carrick, <i>of Corsewell</i>	1829
	More, John Shanks, Advocate	1816
	Moir, Charles Alexander, <i>of Leckie</i>	1814
	Moir, John, Printer, <i>Edinburgh</i>	1804
	Moir, John Macarthur, <i>of Hillfoot and Milton</i>	1834
	Moir, Walter, Sheriff-substitute, <i>Glasgow</i>	1803
	Moncrieff, Robert Scott, <i>younger of Kirkton</i> , Advocate	1831
	Moncrieff, Robert Hope, <i>Perth</i>	1825
	Monro, Dr Alexander, Professor of Anatomy in the Uni- versity of Edinburgh	1807
	Monro, Alexander, <i>younger of Craiglockhart</i> , Rifle Brigade	1835
1440	Montgomery, Robert, Lord Treasurer Remembrancer, <i>Edin.</i>	1829
	Montgomerie, William, <i>of Bellmont</i>	1836
	Monteith, Henry, <i>of Carstairs</i>	1808
	Monypenny, Alexander, W. S.	1827
	Moray, James, <i>of Abercairney</i>	1811
	Moreland, Charles, Banker, <i>Stranraer</i>	1827
	Morrieson, Robert, Hon. E. I. C. S., <i>Edinburgh</i>	1833
	Morton, Sam., Agricultural Implement-Maker, <i>Leith Walk</i>	1822
	Morton, Robert, late Jeweller, <i>Edinburgh</i>	1812
	Morton, Hugh, <i>Leith Walk</i>	1835
1450	Mowat, William Cameron, <i>of Garth</i>	1830
	Moubray, John, <i>of Cambus</i>	1825
	Muir, Andrew, Merchant, <i>Greenock</i>	1826
	Muir, James, Merchant, <i>Greenock</i>	1827
	Muirhead, Claud, Publisher of the Edinburgh Advertiser	1820
	Mundell, Alexander, Solicitor, <i>London</i>	1805
	Mundell, Robert, <i>of Wallacehall</i>	1831
	Munro, Hugh, <i>of Teaminich</i>	1799
	Munro, Hugh Andrew Johnston, <i>of Novar</i>	1832
1460	Munro, Alexander, <i>Prince's Street, Edinburgh</i>	1810
	Munro, George Gunn, <i>of Poyntzfield</i>	1837
	Munro, Colonel William, Madras Army	1825
	Murdoch, John Burn <i>of Coldoch</i>	1820
	Murdoch, John, Factor for Colonel Hunter Blair <i>of Dunskey</i>	1836

		Admitted
	Mure, James O. Lockhart, <i>of Livingstone</i>	1828
	Mure, William, Factor to the Earl of Selkirk	1830
	Murray, Alexander, <i>of Broughton</i>	1822
	Murray, Andrew, <i>of Murrayshall</i> , Sheriff of Aberdeenshire	1804
	Murray, Anthony, <i>of Crieff</i>	1815
1470	Murray, Anthony, <i>younger of Dollerie</i> , W. S.	1828
	Murray, James, of the Monkland Iron-Works	1828
	Murray, The Right Hon. John Archibald, His Majesty's Advocate for Scotland, M. P.	1823
	Murray, John Dalrymple, <i>of Murraythwaite</i>	1825
	Murray, Joseph, <i>of Ayton</i>	1820
	Murray, Patrick, <i>of Simprim</i>	1794
	Murray, Samuel Hood, of H. M. 92d Highlanders	1834
	Murray, William, <i>of Polmaise</i>	1806
	Murray, William, Banker, <i>Tain</i>	1817
	Murray, William, <i>of Banknock</i>	1827
1480	Murray, William, <i>of Henderland</i>	1826
	Murray, William Keith, <i>younger of Ochertyre</i>	1830
	Mutrie, David, Merchant, <i>Glasgow</i>	1804

N

	NORTHLAND, The Right Honourable Thomas, Viscount	1808
	NAPIER, Sir William Milliken, <i>of Milliken</i> , Bart.	1820
	NICHOLSON, Sir Arthur, <i>of Lochend</i> , Bart.	1812
	Nairn, David, <i>of Drumkilbo</i>	1826
	Nairne, James Mellis, <i>of Dunsinane</i>	1821
	Nairne, James, <i>of Claremont</i> , W. S.	1829
	Napier, Robert, Dunmore, <i>of Ballekinrain</i>	1824
1490	Napier, William, <i>of Blackstone</i>	1815
	Neil, Lieut.-Colonel William, <i>of Barweill</i>	1824
	Neill, Patrick, LL.D., Secretary Caledonian Horticult. Soc.	1808
	Neilson, Robert, <i>of Hilton</i>	1831
	Newbigging, John Stewart, W. S.	1836
	Newton, Abraham, Merchant, <i>Leith</i>	1828
	Nicholson, Major Allan Macdonald, <i>of Ardmore</i>	1819
	Nisbet, Archibald, <i>of Carphin</i>	1820
	Nisbet, George More, <i>of Cairnhill</i>	1817
	Niven, William, <i>of Achalton and Kirkbride</i>	1812

O

1500	OGILVIE, The Honourable William, <i>of Airlie</i>	1823
	OGILVIE, The Honourable Donald, <i>of Clova</i>	1824
	OGILVIE, Sir John, <i>of Inverquharity</i> , Bart.	1824

		Admitted
	OSWALD, Lieut.-Gen. Sir John, <i>of Dunnikier</i> , G. C. B.	1824
	ORDE, Sir John Poulet, <i>of Kilmory</i> , Bart.	1830
	Ochterlony, John, <i>of Guynd</i>	1797
	Ogilvie, John, <i>of Inchewan</i>	1836
	Ogilvie, Peter Wedderburn, <i>of Ruthven</i>	1826
	Ogilvie, Captain William, R. N.	1820
	Ogilvie, William, <i>of Chesters</i> , Advocate	1809
5110	Oliphant, Charles, W. S.	1813
	Oliphant, Laurence, <i>of Condie</i> , M. P.	1828
	Oliphant, James, <i>of Gask</i>	1828
	Oliver, Major Archibald, <i>of Bush</i>	1832
	Oliver, Thomas, <i>Lochend</i>	1825
	O'Reilly, Lieut.-Colonel W. F., <i>Fleurs Castle</i>	1833
	Ormiston, John A., <i>of Glenburnhall</i>	1832
	Orr, Charles James Fox, <i>of Thornly Park</i> , W. S.	1816
	Orr, Patrick, W. S.	1825
	Oswald, James, <i>of Shieldhall</i> , M. P.	1829
1520	Oswald, Richard Alexander, <i>of Auchencruive</i>	1803
	Oswald, Colonel Robert, <i>Dunnikier</i>	1824

P

	PANMURE, The Right Honourable William, Lord	1805
	PITMILLY, David Monypenny, Lord, retired Senator of the College of Justice	1804
	PRINGLE, Sir John, <i>of Stitchell</i> , Bart.	1810
	Parish, Woodbine, late Chairman of the Board of Excise	1819
	Parkes, Samuel, <i>of London</i>	1817
	Paterson, Alexander, <i>Thurso</i>	1801
	Paterson, George, <i>of Castle Huntly</i>	1804
	Paterson, John, Factor to the Duke of Hamilton, <i>in Arran</i>	1826
1530	Paterson, John, <i>residing at Borlum</i>	1832
	Paterson, Robert, <i>of Brocklehurst</i>	1835
	Patison, John, W. S.	1806
	Paton, John, <i>of Crailing</i>	1833
	Patrick, Captain James, <i>of Drumbowie</i>	1836
	Patrick, John Sheddan, <i>younger of Trearne and Hazlehead</i>	1833
	Patrick, Robert, <i>of Trearne and Hazlehead</i>	1801
	Patrick, William, <i>of Roughwood</i> , W. S.	1805
	Patton, James Murray, <i>of Glenalmond</i>	1830
	Paul, Henry, <i>of Woodside</i> , Accountant, Glasgow	1830
1540	Paul, William, Accountant, <i>Edinburgh</i>	1829
	Pearson, Alexander, W. S.	1819
	Peddie, James, W. S.	1819

		Admitted
	Peddie, William, Writer, <i>Perth</i>	1828
	Pennycuick, John, <i>of Soilarie</i> , Major 47th Regiment	1823
	Peter, John, <i>Keithick House</i>	1828
	Philip, John, Distiller, <i>Dolls</i>	1828
	Pillans, James, <i>Regent Terrace</i>	1799
	Piper, Edward, <i>Edinburgh</i>	1833
	Pitcairn, John, <i>of Pitcairns</i>	1815
1550	Playfair, William Henry, Architect, <i>Edinburgh</i>	1824
	Pollock, Arthur, Merchant, <i>Grangemouth</i>	1815
	Pollok, William, <i>of Barniehill</i> , M. D.	1833
	Pringle, Alexander, <i>of Whytbank</i> , M. P. for Selkirkshire	1821
	Pringle, James, <i>of Torwoodlee</i>	1806
	Pringle, Captain James, R. N., <i>younger of Torwoodlee</i>	1820
	Prentice, Richard, Solicitor-at-law	1817
	Proctor, William D., <i>of Halkerton</i>	1829

Q

† QUEENSBERRY, The Most Noble Charles, Marquis of, K.T. 1799

R

	RICHMOND and LENNOX, His Grace Charles, Duke of, K. G.	1836
1560	ROTHES, The Right Honourable George William, Earl of,	1837
†	ROSEBERY, The Right Honourable Archibald John, Earl of,	1806
	ROSSLYN, The Right Honourable James Alexander, Earl of	1835
	RAMSAY, The Right Honourable James, Lord	1835
	REAY, The Right Honourable Eric, Lord	1800
	RUTHVEN, The Right Honourable James, Lord	1810
	ROLLO, The Honourable Roger,	1836
	RAE, The Right Honourable Sir William, <i>of St Catharines</i> , Bart. M. P.	1802
	RAMSAY, The Honourable Colonel John, <i>of Dysart</i>	1824
	RAMSAY, Sir James, <i>of Banff</i> , Bart.	1823
1570	RIDDELL, Sir James Milles, <i>of Ardnamurchan and Sunart</i> , Bart.	1808
	RAMSAY, Sir Alexander, <i>of Balmain</i> , Bart.	1813
	RADCLIFFE, Sir Joseph, Bart. <i>of Millsbridge</i> , Yorkshire	1820
	RICHARDSON, Sir John, <i>of Pitfour</i> , Bart.	1823
	Ramsay, Alexander, <i>of Demerara</i>	1806
	Ramsay, George Williamson, <i>of Maxton and Braidgarhill</i>	1832
	Ramsay, R. Wardlaw, <i>of Whitehill and Tilliecoultury</i>	1828
	Ramsay, Captain Thomas, <i>Balmain</i>	1828
	Ramsay, William Ramsay, <i>of Barnton</i>	1831

		Admitted
	Rankine, William, M. D., <i>Fairlie House</i>	1836
1580	Ratray, Robert, W. S.	1805
	Ratray, Robert Clerk, <i>of Craighall Ratray</i> ,	1826
	Ratray, Thomas, <i>younger of Brewlands</i>	1834
	Reid, Dr David Boswell, <i>Edinburgh</i>	1833
	Reid, Gabriel, <i>of Kilcalmkill</i>	1820
	Reid, George, <i>formerly of Ratho Bank</i>	1813
	Reid, John, <i>Henderson Row</i>	1813
	Reid, Sylvester, W. S. Depute Clerk of Teinds	1821
	Rennie, William, Banker, <i>Maybole</i>	1836
	Renny, Robert Walker, Factor on the estate of Pitfour	1827
1590	Renny, William, W. S. Solicitor of Legacy Duties	1820
	Renton, Alexander, <i>of Lamberton</i>	1833
	Renton, David, <i>of Greystonlees</i>	1834
	Reoch, James, Merchant, <i>Leith</i>	1826
	Richardson, James, Wine Merchant, <i>Edinburgh</i>	1833
	Richardson, Ralph, Merchant, <i>Edinburgh</i>	1828
	Richardson, Robert, Merchant, <i>Edinburgh</i>	1837
	Rickman, Thomas, Architect, <i>Birmingham</i> , F. S. A.	1831
	Riddell, Campbell D., Advocate	1816
1600	Riddell, Charles, <i>of Meuseley</i>	1831
	Riddell, John, Advocate	1817
	Ridley, George James, <i>Harbour House, Durham</i>	1833
	Rigg, J. Home, <i>of Morton and Downfield</i>	1824
	Ritchie, Henry, <i>of Busbie</i>	1820
	Ritchie, Robert, Merchant, <i>Edinburgh</i>	1833
	Robb, John, <i>of Blackburn</i> , M. D.	1836
	Robertson, Alexander, W. S.	1825
	Robertson, Andrew, Surgeon <i>at Crathie</i>	1832
	Robertson, Captain, <i>of Kendrochet</i> , late of 88th Regiment	1825
1610	Robertson, Charles, <i>at Buttergask</i>	1836
	Robertson, David, late Agent for the British Linen Company, <i>Perth</i>	1829
	Robertson, Captain George A., of the Honourable East India Company's Service	1817
	Robertson, George, one of the Deputy-Keepers of the General Records of Scotland	1819
	Robertson, George, Factor on the Estates of Brucklay and Fettercairn	1833
	Robertson, Dr Henry, late H. E. I. C. Medical Service, residing <i>at Callander</i>	1832
	Robertson, James, Factor in Argyllshire for the Marquis of Breadalbane	1836

		Admitted
	Robertson, James Stewart, <i>of Edradynate</i>	1811
	Robertson, James Saunders, W. S.	1816
	Robertson, Captain James Walker, R. N.	1823
1620	Robertson, James H., Banker, <i>Greenock</i>	1831
	Robertson, John, <i>Ednam House, Kelso</i>	1831
	Robertson, Captain John, late 14th Foot	1825
	Robertson, Laurence, Cashier for the Royal Bank, <i>Glasgow</i>	1828
	Robertson, Patrick, Advocate	1816
	Robertson, Robert, <i>of Auchleeks</i>	1828
	Robertson, Thomas, <i>Broomlee</i>	1836
	Robertson, William, <i>younger of Kinlochmoidart</i> , Advocate	1826
	Robertson, William, junior, W. S.	1834
	Robinson, George Garden, <i>Banff</i>	1811
1630	Robison, John, Secretary to the Royal Society of Edin.	1830
	Roger, William, Merchant, <i>Glasgow</i>	1825
	Rogerson, Dr John, <i>of Wamphray</i>	1804
	Rogerson, William, <i>of Gillesbie</i>	1829
	Rolland, Adam, <i>of Gask</i> , Principal Clerk of Session	1832
	Rose, Major-General John, <i>of Holm and Castlehill</i>	1831
	Ross, Hugh Rose, <i>of Glastullich and Cromarty</i>	1824
	Ross, Colonel John Gray, late 1st or Royal Veteran Batta- lion	1836
	Ross, Richard Louthian, <i>of Staffold</i>	1804
	Ross, William, <i>of Bridgebank</i>	1803
1640	Roy, John James, Factor on the estate of Invercauld	1825
	Roy, Robert, W. S.	1822
	Russell, Claud, Accountant, Auditor of Accounts to the Society	1807
	Russell, Francis Whiteworth, <i>Forres House</i>	1835
	Russell, Henry, Provost of Dunfermline	1836
	Russell, James, <i>of Aden</i>	1834
	Russell, Colonel James, <i>of Ashiesteil</i> , C. B.	1832
	Russell, James, <i>of Blackbraes</i>	1834
	Russell, John, W. S.	1806
	Russell, Robert, <i>of Dalnair</i>	1834
1650	Rutherford, William Oliver, <i>of Edgertoun and Dinlabyre</i>	1825
	Ryrie, Stewart, of the Commissariat Department	1824

S

SUSSEX, His Royal Highness Prince Augustus Frederick, Duke of,	1806
§ SUTHERLAND, Her Grace Elizabeth, Duchess-Countess of	1784

	* SUTHERLAND, His Grace George Granville, Duke of, President of the Society	1813
	SUTHERLAND, Her Grace Harriet, Duchess of	1834
	SPENCER, The Right Honourable John Charles, Earl, Honorary Member	1837
	STRATHMORE, The Right Honourable Thomas, Earl of	1820
	SELKIRK, The Right Honourable Dunbar James, Earl of	1830
	STIRLING, The Right Honourable Alexander, Earl of	1825
1660	† STRATHALLAN, The Right Honourable James, Viscount	1811
	† SALTOUN, The Right Honourable Alexander George, Lord	1820
	STORMONTH, The Right Honourable David, Lord Viscount, M. P.	1833
	SINCLAIR, The Right Honourable Charles, Lord	1829
	SCOTT, Right Honourable Lord John, M. P. for Roxburghshire	1833
	STUART, The Right Honourable Lord James, M. P.	1819
	SILVESTRE, The Baron de, Member of the Institute, Perpetual Secretary of the Royal and Central Society of Agriculture, Paris, Honorary Member	1836
	SCOT, The Honourable Henry Francis, <i>of Harden</i>	1829
	SHEPHERD, The Right Honourable Sir Samuel	1820
	STUART, Lieut.-General, The Honourable William	1826
1670	STUART, The Honourable Charles	1826
	STUART, The Honourable Lieutenant-General Patrick, Commanding the Forces in North Britain	1833
	STUART, The Honourable John	1824
	SANDILANDS, The Honourable Robert, <i>of Torphicken</i>	1831
	SETON-STEUART, Sir Reginald Macdonald, Bart. <i>of Staffa and Touch</i> , Sheriff of Stirlingshire, Honorary Secretary of the Society	1796
	SETON, Sir William, <i>of Pitmedden</i> , Bart.	1834
	SINCLAIR, Sir John Gordon, <i>of Stevenston and Murkle</i> , Bart.	1832
	SINCLAIR, Sir George, <i>of Ulbster</i> , Bart. M. P., for Caithnessshire	1812
	STIRLING, Sir Samuel, <i>of Glorat</i> , Bart.	1809
	SCOTT, Sir William, <i>of Ancrum</i> , Bart	1829
1680	STEWART, Sir John Archibald, <i>of Grandtully</i> , Bart.	1819
	STIRLING, Sir Gilbert, <i>of Rosehall and Larbert</i> , Bart.	1806
	STRATON, Major-General Sir Joseph, <i>of Kirkside</i> , C. B.	1827
	Salmon, Henry, Banker, <i>Falkirk</i>	1834
	Sandeman, David, W. S.	1831
	Sanders, James, M. D. <i>Edinburgh</i>	1818
	Sandford, Erskine Douglas, Advocate	1827

		Admitted
	Sands, James, <i>at Blarcessnock</i>	1817
	Sawers, John, <i>of Loanhead</i> , Procurator-Fiscal, Stirlingshire	1834
	Scarth, James, Banker, <i>Leeds</i>	1828
1790	Scales, Andrew, of the Customs, <i>Leith</i>	1828
	Scot, Alexander, <i>of Trinity Mains</i> , W. S.	1818
	Scotland, John, Factor to Lord Douglas	1835
	Scott, Charles B. <i>of Woll</i> , W. S.	1826
	Scott, Charles, Merchant, <i>Greenock</i>	1831
	Scott, David, of Bengal Civil Service	1823
	Scott, Lieutenant-Colonel George, <i>Edinburgh</i>	1821
	Scott, James, <i>of Brotherton</i>	1805
	Scott, John, <i>of Hawkhill</i>	1830
	Scott, John, <i>younger of Hawkhill</i> , Merchant, <i>Greenock</i>	1826
1700	Scott, Captain Robert, <i>of Abbethune</i>	1826
	Scott, Robert Haldane, <i>of Kinloss and Wodden</i>	1832
	Scott, Lieutenant-General Thomas, <i>of Malleny</i>	1824
	Scott, Thomas Rennie, Factor to Lord Douglas	1827
	Scott, William, <i>of Tiviotbank</i> , W. S.	1835
	Scrymsour, James Fotheringham, <i>of Tealing</i>	1829
	Selkrig, Charles, Accountant, <i>Edinburgh</i>	1810
	Sellar, Patrick, <i>of Westfield</i>	1813
	Seton, Archibald Macdonald Steuart, <i>Staffa</i>	1835
	Seton, Henry Macdonald Steuart, <i>younger of Staffa and Touch</i>	1835
1710	Shairp, Major Norman <i>of Houston</i>	1828
	Shand, William, <i>late of Arnhall</i>	1827
	Shanklie, John, Merchant, <i>Edinburgh</i>	1831
	Sharpe, Lieutenant-General M. <i>of Hoddam</i> , M. P.	1830
	Shaw, Charles, W. S. residing at Lochmaddy, <i>North Uist</i>	1835
	Shaw, David, W. S. <i>Ayr</i>	1836
	Shaw, Duncan, Factor to Lord Macdonald	1815
	Shaw, John, Writer, <i>Cupar</i>	1836
	Shaw, Patrick, Advocate	1835
	Shearer, James, Surveyor, G. P. Office	1800
1720	Shepherd, James, W. S.	1828
	Shepherd, Alexander, Solicitor, <i>Inverness</i>	1819
	Sheriff, Charles, Sheriff-substitute, <i>Orkney</i>	1829
	Short, Francis, <i>of Courance</i>	1804
	Silver, George, <i>of Netherley and Balnagubs</i>	1835
	Sim, Adam, <i>of Coulter Mains</i>	1836
	Simpson, Alexander, <i>at Helmsdale</i>	1821
	Simpson, Alexander, <i>Leith</i>	1828
	Simpson, Alexander Horatio, <i>Paisley</i>	1830

		Admitted
	Simpson, Dugald, Distiller, <i>Helmsdale</i>	1830
1730	Simpson, William, Advocate, <i>Aberdeen</i> , Procurator-Fiscal for Aberdeenshire	1835
	Sinclair, Dugald, <i>Kilchamaig</i>	1826
	Sinclair, James, of <i>Forss</i>	1830
	Sinclair, John, of <i>Barrock</i>	1824
	Sinclair, John, of <i>Lochaline</i>	1834
	Sinclair, John, of <i>Redcastle</i>	1837
	Sinclair, J. W. of <i>Freswick</i>	1832
	Sinclair, Robert, Merchant, <i>Greenock</i>	1826
	Sinclair, William, <i>Freswick</i>	1811
	Singer, Reverend William, D. D. <i>Kirkpatrick-juxta</i>	1808
1740	Skene, George, younger of <i>Rubislaw</i> , Advocate	1831
	Skene, Patrick George, of <i>Hallyards</i>	1825
	Skene, William F., W. S.	1831
	Skene, William Gordon Cumming, of <i>Pitlurg und Dyce</i>	1830
	Skinner, C. G. Macgregor, late Captain 1st Dragoon Guards	1823
	Skinner, James, at <i>Drum</i> , Factor to the Duke of Richmond	1827
	Sligo, George, of <i>Auldhame</i>	1827
	Sligo, John, of <i>Carmyle</i>	1827
	Small, Patrick, of <i>Diranean</i>	1826
	Smith, Alexander, of <i>Glenmillan</i> , Advocate, <i>Aberdeen</i>	1822
1750	Smith, Charles Hope Johnston, Garden Architect, <i>Edinburgh</i>	1836
	Smith, David, W. S.	1833
	Smith, George, <i>Moffat</i> , Surgeon, R. N.	1829
	Smith, James, of <i>Jordanhill</i>	1823
	Smith, James, Manager of the <i>Deanston Cotton-Works</i>	1821
	Smith, James, of <i>Craigend</i>	1825
	Smith, John, of <i>Swinridgmuir</i>	1799
	Smith, Thomas, Banker, <i>London</i>	1798
	Smith, Thomas, at <i>Penfillan</i>	1834
	Smith, William, Merchant, <i>Glasgow</i>	1823
1760	Smyth, Robert Gillespie, of <i>Gibliston</i>	1834
	Smyth, Francis, of <i>Knockomie</i>	1836
	Smollett, J. R., of <i>Bonhill</i> , Captain R. N.	1818
	Smollett, Alexander, younger of <i>Bonhill</i> , Advocate	1826
	Spearman, Henry John, of <i>Thornley Hall</i> , <i>Durham</i>	1835
	Speid, Robert, of <i>Ardovie</i>	1819
	Speirs, Graham, Advocate, Sheriff of <i>Moray and Nairnshires</i>	1836
	Spens, Lieutenant-Colonel James, late 73d Regiment	1790
	Spottiswoode, John, of <i>Spottiswoode</i>	1812
	Spottiswoode, John Brodie, of <i>Muiresk</i>	1834
1770	Sprot, James, of <i>Sprot</i>	1830

		Admitted
	Sprot, John, <i>Picardy Place, Edinburgh</i>	1830
	Sprot, Mark, <i>of Garnkirk, Advocate</i>	1820
	Sprot, Mark, <i>of Riddell</i>	1830
	Sprot, Thomas, W. S.	1826
	Stables, William Alexander, <i>of Park</i>	1836
	Stavert, Thomas, <i>of Hosecoat</i>	1827
	Steele, William, <i>Advocate</i>	1828
	Stephens, Henry, <i>Redbrae Cottage, Bonnington</i>	1826
	Stephens, George, <i>Land-Drainer, Member of the Swedish Academy of Agriculture, &c.</i>	1837
1780	Stephen, Moses, <i>of Polmadie, Advocate</i>	1832
	Stevenson, Alexander, S. S. C.	1813
	Stevenson, Duncan, <i>Printer to the University of Edin.</i>	1824
	Stevenson, Captain Hugh, <i>late Argyllshire Militia</i>	1805
	Stevenson, Robert, <i>Civil-Engineer, Edinburgh</i>	1807
	Stevenson, Thomas, <i>Merchant, Leith</i>	1831
	Steuart, Patrick, <i>of Auchlunkart</i>	1800
	Steuart, Robert, <i>of Alderston, M. P.</i>	1828
	Stewart, Allen, <i>of Bonrannock</i>	1809
	Stewart, Alexander, <i>of Dercullich</i>	1805
1790	Stewart, Lieut.-Colonel Alexander, <i>of Strathgarry</i>	1808
	Stewart, Charles, <i>of Ardsheal</i>	1794
	Stewart, Charles, <i>of Hillside</i>	1823
	Stewart, Charles, <i>of Ballahulish</i>	1827
	Stewart, Charles, <i>of Chesthill</i>	1834
	Stewart, Donald, <i>Factor on the estate of Harris</i>	1817
	Stewart, Captain Dugald	1799
	Stewart, Captain Houston, R. N.	1822
	Stewart, James, <i>Merchant, Greenock</i>	1825
	Stewart, Captain James, <i>of Crossmount</i>	1821
1800	Stewart, John, <i>of Belladrum</i>	1819
	Stewart, John Lorn, <i>of Glenbuckie</i>	1824
	Stewart, John, <i>of Dalguise</i>	1823
	Stewart, John Shaw, <i>Advocate</i>	1816
	Stewart, John, <i>of Fasnacloich</i>	1817
	Stewart, John, <i>of Binny</i>	1809
	Stewart, Captain John, <i>of the Pr. of Wales Excise Yacht</i>	1809
	Stewart, John, <i>of Crossmount</i>	1801
	Stewart, John, <i>of Achadashenaig</i>	1824
	Stewart, Major Ludovick, <i>at Pittyvaich</i>	1806
1810	Stewart, Patrick Maxwell, <i>Merchant, London, M. P.</i>	1813
	Stewart, Pat. G. <i>Agent for the Bank of Scotland, Perth</i>	1829
	Stewart, Robert, <i>younger of Ardvorlich</i>	1823
	Stewart, Robert, <i>of Stewarthall</i>	1825

		Admitted
	Stewart, Robert, <i>of Carfin</i> , W. S.	1833
	Stewart, Stair, <i>of Physgill</i>	1828
	Stewart, William, <i>of Ardvorlich</i>	1799
	Stewart, William, <i>of Glenormiston</i>	1833
	Stewart, William, Sheriff-clerk, <i>Kincardineshire</i>	1825
	Stewart, William, <i>Mains of Skellater</i>	1829
1820	Stewart, William, W. S.	1833
	Stirling, General A. Graham, <i>of Duchray and Auchyle</i>	1801
	Stirling, Alexander Gartshore, <i>of Craigbarnet</i>	1818
	Stirling, Charles, <i>of Kenmore</i>	1803
	Stirling, Charles, <i>of Gargunnoch</i>	1836
	Stirling, John, <i>of Blackgrange</i>	1818
	Stirling, John, <i>of Kippendavie</i>	1833
	Stirling, Patrick, <i>younger of Kippendavie</i>	1813
	Stirling, Major William Moray, <i>of Ardoch</i>	1825
	Stirling, William, <i>of Content</i>	1823
1830	Stocks, David, <i>of Invernyle</i>	1836
	Stoddart, Alexander, <i>of Ballendreck</i>	1829
	Stodart, John, <i>Cartland Mains</i>	1829
	Stott, Gibson, <i>of Balloch Castle</i>	1832
	Strang, William, <i>Lopness, Orkney</i>	1819
	Stronach, John, <i>at Muiryfold</i> , Factor to the Earl of Fife	1823
	Stuart, Alexander, <i>of Laithers</i>	1835
	Stuart, James, S. S. C.	1822
	Sutherland, Captain George Mackay, <i>of Udoll</i>	1832
	Swan, James, W. S.	1813
1840	Swinton, Archibald, W. S.	1800
	Swinton, George, late Chief Secretary to the Supreme Government of India	1834
	Swinton, John, <i>Inverleith Place</i>	1810
	Swinton, Samuel, <i>of Swinton</i>	1829
	Symons, John, M. D., <i>Dumfries</i>	1829

T

†	TWEEDDALE, Most Noble George, Marquis of, K. T.	1809
	TRAQUAIR, The Right Honourable Charles, Earl of	1811
	TALBOT, The Right Honourable John, Earl of, K. P., Honorary Member	1837
	TORPHICHEN, The Right Honourable James, Lord	1821
	THRIEPLAND, Sir Patrick Murray, <i>of Fingask</i>	1824
1850	THOMSON, Sir John Deas, late Accomptant-General, Royal Navy	1801
	Tait, George, Advocate	1806
	Tait, George, <i>of Langrig</i>	1825

		Admitted
	Tait, John, <i>of Pirn</i> , W. S.	1816
	Tait, John, Advocate, Sheriff of Kinross and Clackmannan	1834
	Tawse, Andrew, W. S.	1836
	Tawse, John, Advocate, Secretary to the Society for propagating Christian Knowledge	1825
	Taylor, Major Alexander Francis, <i>Rothiemay House</i>	1814
	Taylor, Robert, <i>of Broomlands</i>	1833
	Taylor, William, Merchant, <i>Leith</i>	1828
1860	Tenant, Charles, <i>of St Rollox</i>	1833
	Thom, Robert, <i>of Ascog</i>	1818
	Thomson, Alexander, <i>of Banchory</i>	1821
	Thomson, Alexander, Banker, <i>Greenock</i>	1825
	Thomson, David, W. S.	1809
	Thomson, George, <i>of Burnhouse</i> , Advocate	1836
	Thomson, James, <i>younger of Earnslaw</i>	1828
	Thomson, John, Bookseller, <i>Edinburgh</i>	1811
	Thomson, John, <i>Craigie</i>	1836
	Thomson, John, Cashier of the Royal Bank of Scotland	1833
1870	Thomson, Robert, Advocate, Sheriff of Caithness	1835
	Thomson, Thomas, Advocate, Principal Clerk of Session	1807
	Thomson, William, <i>of Woodhouse</i>	1828
	Threshie, David Scott, W. S.	1824
	Threshie, Robert, <i>of Barnbarroch</i>	1835
	Tod, Hugh, W. S.	1817
	Tod, Peter, <i>of Meikleholmside</i>	1829
	Torrance, George Mackmicken, <i>of Kilsaintninian</i>	1827
	Torrance, Thomas, <i>Meadowhead</i>	1831
	Torrance, William, <i>Gilmerton</i>	1831
1880	Torrie, Thomas Jameson, <i>Royal Circus, Edinburgh</i>	1867
	Traill, George, <i>younger of Ratter</i>	1822
	Traill, James, <i>of Ratter</i>	1797
	Traill, Thomas Stewart, M. D., Professor of Medical Jurisprudence in the University of Edinburgh	1834
	Traill, William, <i>of Woodnick, Orkney</i>	1821
	Trotter, Alexander, <i>of Dreghorn</i>	1822
	Trotter, Captain Robert Knox, <i>of Ballindean</i>	1829
	Trotter, John P., Advocate	1831
	Trotter, Richard, <i>of Hapland</i> , Advocate	1836
	Trotter, Thomas, <i>younger of Crooksfield</i> , W. S.	1828
1890	Trotter, Young, <i>of Crooksfield</i>	1828
	Turnbull, Archibald, <i>of Bellewood</i>	1826
	Turnbull, George, <i>of Abbey St Bathans</i> , W. S.	1833
	Turner, Geo. <i>of Menie</i> , Lieut.-Col. Royal Horse Artillery	1828

		Admitted
	Turner, William, Surgeon, <i>Greenock</i>	1831
	Tytler, William Fraser, <i>of Balnain and Burdsyards, Sheriff of Inverness-shire</i>	1802
U		
	Ure, John, <i>of Croy Cunningham</i>	1818
	Urquhart, Beauchamp Colclough, <i>of Byth and Meldrum</i>	1834
V		
	Veitch, Henry, <i>of Elliock</i>	1802
	Veitch, James, <i>younger of Elliock</i>	1822
1900	Veitch, John, <i>of Woodside, Merchant, Leith</i>	1833
	Vere, Daniel, <i>of Stonebyres, Advocate</i>	1807
	Vere, James J. Hope, <i>of Craigiehall</i>	1816
W		
	WELLINGTON, Field-Marshal His Grace Arthur, Duke of, K. G. &c. Honorary Member	1815
	† WEMYSS and MARCH, The Right Hon. Francis, Earl of	1793
	† WILLOUGHBY DE ERESBY & GWYDIR, The Right Honourable P. Drummond Burrell, Lord	1808
	WESTERN, The Right Hon. John Lord, Honorary Member	1837
	WARRENDER, The Right Hon. Sir George, <i>of Lochend, Bart.</i>	1804
	WALKER, Sir Patrick, <i>of Coates, Knight, Usher of the White Rod</i>	1803
	Wood, Commissary-General Sir Gabriel, Knight	1830
1910	Waddell, George, <i>of Ballochnie, W. S.</i>	1824
	Waddell, William, <i>of Easter Moffat, W. S.</i>	1818
	Waldie, Archibald, Agent for the Commercial Banking Company, <i>Kelso</i>	1824
	Waldie, John, <i>of Henderside</i>	1826
	Walker, Bethune, <i>of Fallfield</i>	1835
	Walker, David, Civil-Engineer and Land-Surveyor, <i>Aberdeen</i>	1831
	Walker, James, <i>Suttie, Fintray</i>	1835
	Walker, James, <i>of Dalry, Sheriff of Wigtonshire</i>	1835
	Walker, John, <i>of Cramfordton</i>	1834
	Walker, Robert, <i>at Ferrygate</i>	1834
1920	Walker, William, <i>of Bonland</i>	1835
	Walkinshaw, Robert, <i>of Parkhouse, Sheriff-clerk of Renfrewshire</i>	1828
	Wallace, Robert, <i>of Kelly, M. P.</i>	1825
	Warden, Robert, <i>of Parkhill</i>	1820

		Admitted
	Wardrop, John, Banker, <i>Edinburgh</i>	1807
	Wason, Rigby, of <i>Mayfield</i> , M. P. for Ipswich	1836
	Watson, Andrew, of <i>Bridge Castle</i> , W. S.	1798
	Watson, George, Portrait Painter, <i>Edinburgh</i>	1826
	Watson, Hugh, <i>Keillor Farm</i>	1828
	Watson, John, Manager of the <i>Edin. Gas Light Comp.</i>	1825
1930	Watson, William Dickson, <i>late of Press</i>	1810
	Watt, James, of <i>Cranfordsdyke</i>	1825
	Watt, Robert, Factor on the estates of Closeburn and Mansfield	1835
	Wauchope, George, <i>Moray Place</i>	1824
	Wauchope, John, of <i>Edmonstone</i>	1813
	Waugh, John, Bookseller, <i>Edinburgh</i>	1828
	Wedderburn, David, of <i>Pearsie</i>	1831
	Wedderburn, Henry S. of <i>Wedderburn and Birkhill</i> ,	1819
	Wedderburn, John, <i>Devonshire Street, Portland Place,</i> <i>London</i>	1819
	Weir, Thomas, of <i>Bogangreen</i>	1835
1940	Welsh, David, of <i>Collin</i> , W. S.	1830
	Welsh, James, at <i>Earlshaugh</i>	1826
	Welsh, John, W. S. Sheriff-clerk of Peeblesshire	1833
	Welsh, Robert, S. S. C.	1830
	Wemyss, James, W. S.	1825
	Wemyss, James Erskine, of <i>Wemyss</i> , Capt. R. N., M. P. for Fifeshire	1823
	Wemyss, The Rev. James, of <i>Orwell</i>	1837
	Wemyss, William, <i>Cuttlehill</i>	1829
	Wetherell, William, Land Agent, <i>Durham</i>	1836
	Whigham, George, of <i>Hallidayhill</i>	1816
1950	Whigham, Robert, of <i>Lochpatrick</i> , Advocate	1827
	White, Adam, of <i>Fens</i> , Merchant, <i>Leith</i>	1801
	White, Alexander, Merchant, <i>Leith</i>	1829
	White, John, Merchant, <i>Edinburgh</i>	1806
	Whyte, Thomas, of <i>Glenesslin</i>	1829
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	Wilkie, John, of <i>Foulden</i>	1830
	Wilkie, William, of <i>Ormistonhill</i>	1824
	Williamson, Lieut.-Col. David, late of the 92d Regiment	1826
1960	Williamson, John W., Agent for the British Linen Com- pany, <i>Kinross</i>	1829
	Wilsone, George, of <i>Benmore</i>	1826
	Wilson, James, Sheriff-clerk, County of Edinburgh	1822
	Wilson, John, of <i>Auchineden</i>	1835

		Admitted
	Wilson, John, <i>of Thornly</i>	1830
	Wilson, John, <i>of Cumledge</i>	1828
	Wilson, John, Professor of Moral Philosophy in the University of Edinburgh	1835
	Wilson, John, Factor to the Duchesse de Coigny	1835
	Wilson, William Rae, <i>of Kelvinbank</i>	1807
	Wilson, William, Factor for the Earl of Glasgow	1804
1970	Wilson, Wilson Dobie, Advocate	1827
	Wood, William, Merchant, <i>Leith</i>	1828
	Wood, John, Factor on the estate of Balcarras	1835
	Woodburn, William, Commissioner on the estates of Nithsdale and Terregles	1829
	Wooley, Richard, <i>Wester Dalry</i>	1821
	Wright, Major-General, Royal Engineers	1833
	Wright, James, <i>of Lawton</i>	1817
	Wright, Thomas Guthrie, Auditor of Accounts, Court of Session	1824
	Wyld, James, <i>of Gilston</i> , Merchant, <i>Leith</i>	1802
	Wyllie, David, <i>Edinburgh</i>	1825
1980	Wylie, James, Factor for the Marquis of Breadalbane	1833

Y

	Yorstoun, Rev. John, <i>of Craigenvey</i> , Minister of Torthorwald	1837
	Young, Alexander, <i>of Harburn</i>	1810
	Young, Archibald, Procurator-Fiscal, <i>Banff</i>	1825
	Young, John, <i>of Cliesh</i>	1807
	Young, Samuel D. <i>of Gullyhill</i>	1826
	Young, William, <i>of Burghead</i>	1813
	Young, William, W. S.	1821
	Younger, William, <i>of Craigielands</i>	1826
	Yule, Captain Patrick, Royal Engineers	1827
1990	Yule, John, Factor to Sir James Graham, <i>of Netherby</i> , Bart. M. P.	1828

I N D E X.

INDEX.

- Agricultural garden, report made to his Grace the Duke of Buccleuch and Queensberry relative to the one formed at Smeaton, in Dalkeith Park..... 259
- Arran, account of the Island of..... 125
- Beef and pork, report of the Committee on them for the premium offered in 1833, in the counties of Lanark, Renfrew, and Dumbarton..... 55
- Bell, William, Esq. on the whin as a fence..... 466
- Berwickshire, a geological survey of 171
- Bishop, Mr Thomas, his report on the introduction of certain new forest trees into the cultivation of Scotland..... 121
- Blaikie, Mr, his report on the system of improvement followed on the estates of Mr Menzies of Pitfodels by the settlement of crofters..... 97
- Boswell, John, Esq. on the comparative advantages of feeding cattle in close byres and open hemmels..... 461
- Bridge of suspension, description of one..... 166
- Brooke, Mr, his circular coulter or skiff adapted to the common plough..... 396
- Buist, Mr, his memorandum communicated by Sir John Hall, Bart., regarding experiments in growing rye-grass of different varieties..... 354
- Cart, corn or hay, description of an improved..... 395
- Carmichael, Mr James, his account of the principal limestone quarries in Scotland..... 57
- Cattle, experiment made on the comparative advantages of feeding them on raw or steamed food, 52—on the comparative advantages of feeding them in close byres and open hemmels..... 461
- Clover, Alsike, account of..... 256
- Coulter, a circular one, or skiff, adapted to the common plough... 396
- Crofters, report of the system of improvement followed on the estates of Mr Menzies of Pitfodels, by the settlement of, 97—on the settlement of them at Banchory, 379—report on the settlement of them on the estate of Kilcoy, 384—settlement of them on waste land on the estate of Castle Fraser..... 387
- Dempster, George, Esq. his report relative to plantations..... 155
- Drum of the thrashing machine, improvement in the mode of placing it.....
- Farquharson, Rev. James, of Alford, note respecting the cultivation of the potato..... 48
- Ferns, on the extirpation of them from pasture-land, where the plough cannot be used,371, 376
- Fraser, Colonel, his account of the settlement of crofters on waste-land on the estate of Castle Fraser, Aberdeenshire..... 387
- Geological surveys, note on..... 169
- Geological survey of Berwickshire, 171—of the coal-fields in the

- south-east of Fifeshire, 265—of Morayshire..... 417
- Grorie, Mr Archibald, his account of a new tare (*Vicia villosa*) to this country..... 255
- Gray, Mr Roderick, his account of the mode of planting practised on the property of the Merchant Maiden Hospital of Edinburgh, in the north-east coast of Scotland, 355—on the refuse of herrings as manure..... 465
- Hepburn, J. Stewart, Esq., his description of a conical and grooved pulverising land-roller..... 471
- Herrings, on their refuse as manure..... 465
- Highland and Agricultural Society, royal warrant for a new and supplementary charter for it, 13—bye-laws of it passed referable to the provisions of the charter..... 24
- Howden, Mr Andrew, his report of experiments on the comparative value of different varieties of the potato..... 85
- Hunter, Mr, his description of his stone-planing machine..... 161
- Lanarkshire, on the present state of the Upper Ward of..... 361
- Landale, Mr David, his report on the geology of the east of Fife coal-field..... 265
- Larches, report by Mr Lawson on those raised by him from seed imported from the Tyrol..... 391
- Lawson, Mr Charles, on the *Pinus Austriaca*, or black fir of Austria, 359—his report of larches raised by him from seed imported from the Tyrol..... 391
- Limestone, account of the methods of calcining it at some of the limestone quarries of Scotland, viz. Closeburn, 441; Kilnhead, 445; Baldoran, 447; Burbieston, ib.; Old Kilpatrick, ib.; Netherston, 448; Charlestown, ib.; Gilmerton, 450; East Camps, ib.; Wester Camps, ib.; Mansfield, ib.—General remarks regarding the working of lime-quarries, 451 mining, 453—machinery, 454—kilns..... 454
- Macdonald, Messrs George and James, on the partial failure of the potato crop..... 27
- Mackenzie, Colin, Esq. his report relative to plantations, 157—his report of the settlement of crofters on the estate of Kilcoy..... 384
- Mackenzie, Sir George, Bart., on preserving potatoes and raising them from seed..... 349
- M^cTurk, Mr, on the extirpation of ferns from pasture lands, where the plough cannot be used..... 371
- Malker and Winder, Messrs, on the partial failure of the potato crop..... 34
- Martin, Mr John, on the geology of Morayshire..... 417
- Maule's, Mr, improved chain-plough..... 292
- Middlemiss, Mr, description of an improved double-action pump, for raising water; and an improved syphon..... 49
- Milne, David, Esq. his geological survey of Berwickshire..... 171
- Murray, Hon. James, on the best means of eradicating ferns from pastures..... 376
- Nisbett's, Mr Robert, description of a syringe for bathing and smearing sheep..... 254
- Paterson, Mr John, his account of the Island of Arran..... 125
- Peat-moss, description of Lord Willoughby D'Eresby's machine for compressing it..... 458
- Pinus Austriaca*, on the..... 359
- Plantations, reports relative to, 155—by George Dempster, Esq. of Skibo, 155—by Colin Mackenzie, Esq. of Kilcoy..... 157
- Planting, account of the mode practised on the property of the Merchant Maiden Hospital of Edinburgh, in the north-east coast of Scotland..... 355
- Plough, on an improved chain, 392—circular coulter adapted to the common..... 396
- Potato crop, essays on the partial failure of the,—viz. By Messrs George and James Macdonald, Huntly, 27—Messrs Malker and Winder, Liverpool, 34—Mr Robert Fairbairn, Grange Cottage, Causewayside, 38—Mr James Waldie, Berbeth Mains, Ayr-

- shire, 38.—Mr W. Anderson, 39.—Mr J. McClymont, Balsaggart, Ayrshire, 39.—Mr Thomas Macvitie, Craigshiels, Dumfriesshire, 40.—Mr James Waddell, Dunoon, Argyllshire, 40.—Mr Smith of Penfillan, 41.—Mr J. Caughey, Belfast, 41.—Mr William Wilson, Taylor's Land, Dumfriesshire, 42.—Mr James Jackson, Plaintree Shade, Midlothian, 43.—Mr Bryce Wright, Woodland, Ayrshire, 43.—Mr George Heron, Kilwinning, Ayrshire, 44.—Mr Peter Cowan, Antrim Castle, Ireland, 44.—Note respecting the cultivation of the, 48.—report of experiments on the comparative value of different varieties of the, 85.—on preserving and raising it from seed, 349.—report on the failure of it, 477.—the proper period of planting, 478.—the period of *lifting*, and whether the reed should be *ripe* or *unripe*, 480.—the proper mode of *preserving* them for planting, 481.—the proper preparation of the ground, 482.—the state of the dung, 488.—from what localities the seed should be procured, and whether it should be entire or in cuttings, 493.—whether the plant is weakened or worn out, and whether it is expedient to cultivate it more by the apple and less by the tuber than has been done..... 501
- Preliminary notice, containing petition to the King for a modification of the Society's charter... 1
- Pump, description of an improved double-action one for raising water 49
- Quarries, account of the principal limestone ones in Scotland, 57.—Burdiehouse and Gilmerton, 60.—Mount Lothian, 61.—Fullarton, 62.—Side, 62.—Bents, 62.—Whitefield, 62.—Carlops, 63.—Hemperston, 63.—Middleton, 63.—Blinkbonny, 64.—Crichton Dean, 65.—Cousland, 65.—Salton, 65.—Jerusalem, 66.—Sunnyside, 66.—East Barns, 66.—Skateraw, 67.—Harelaw, 67.—East Camps, 67.—Raw Camps, 68.—Levenseat, 68.—Gateshiel, 68.—North Silver Mine, 69.—Duddingston, 69.—Murrayshall, 70.—Craigend, 70.—Cambernauld, 71.—Netherwood, 71.—Campsie, 72.—Hurlet, 72.—Househill, 72.—Arden, 73.—Thornton House, 73.—Braehead, 73.—Cessnock, 73.—Balgarggan, 74.—Halton, 54.—Craighead, 54.—Tarmitchell, 74.—Aldoon, 75.—Craigneil, 75.—Gaswater, 75.—Benston, 76.—Craigdullet, 76.—Closeburn, 76.—Portesbon, 78.—Bangry, 79.—Charlestown, 79.—Douloch, 80.—Inverbeil, 80.—Chapel, 80.—Forther, 80.—Pitlessie, 81.—Roscobbie, 81.—Hedderwick, 81.—Limefield, 82.—West Pittendreich, 82.—Comparative view of the limestone ones in Scotland..... 84
- An account of the principal marble, slate, sandstone, and greenstone ones in Scotland, 398.—method described of slicing marble blocks, 398.—marble, 400.—slate, 400.—Ballihulish, 400.—Aberfoyl, 402.—sandstone, 403.—Dunbar, 405.—Jerusalem, 405.—Redhall, 405.—Nitshill, 406.—Giffnock, 407.—Giffnock, new, 407.—Eastwood pavement, 407.—Newton, 407.—Killawbridge, 408.—Duloch, 408.—Mylnefield, 409.—Lochee, 410.—Forfar, 410.—Carmyllie, 410.—Leys, 411.—Caithness flags, 412.—greenstone, 413.—South Queensferry, 413.—Stirling, 414.—method of breaking road-metal and blasting whinstone 415
- General observations on limestone 451
- Robertson, Robert, improved corn and hay cart..... 395
- Roller, description of a conical and grooved pulverising land 471
- Rye-grass, experiments in growing different varieties of 354
- Stephens, Mr George, his account of the Alsike clover (*Trifolium hybridum*)..... 256
- Stone-planing machine, description of it..... 161
- Syphon, an improved..... 49
- Syringe for bathing and smearing sheep, description of one..... 254

Tare, account of a new one to this country.....	255	tages of feeding cattle on raw or steamed food.....	52
Thomson, Alexander, Esq., on the settlement of crofters.....	379	Wallace, Mr John, his account of the methods of calcining limestone in some of the limestone-quarries in Scotland.....	446
Trees, report on the introduction of certain new forest ones into the cultivation of Scotland.....	121	Waste land, improvement of.....	451
Tyrol, report of Mr Lawson on larches raised by him from seed imported from the.....	391	Whin, on it as a fence.....	466
		Wilson, Mr David, on the present state of the Upper Ward of Larnarkshire.....	361
Walker, Mr Robert, his experiment on the comparative advancement of feeding cattle on raw or steamed food.....		Young, Mr John, his description of a bridge of suspension.....	161

PREMIUMS

OFFERED BY

**THE HIGHLAND AND AGRICULTURAL
SOCIETY OF SCOTLAND,**

FOR PROMOTING

**AGRICULTURE AND INTERNAL IMPROVEMENT
IN SCOTLAND,**

IN

CONTENTS.

PRELIMINARY NOTICE,	Page 4
Notice to Candidates, and General Regulations of Competition,	5
Office-bearers and Directors,	7-8
Chairmen of Standing Committees,	8

ESSAYS AND REPORTS.

1. Geological Surveys,	9
2. Reports on Coal Districts,	11
3. Improvements on Thrashing Machines,	12
4. Inflammatory Complaints of Farm-Horses,	12
5. Feeding of Farm-Horses on Raw and on Prepared Food,	13
6. Feeding of other Live-Stock,	13
7. Comparative Experiments on the Feeding of Stock in Close Houses, and in open Sheds or Hemmels,	14
8. Pruning of Forest Trees,	15
9. Improvement of Flax Mills,	16
10. Improved Method of Making Hay,	16
11. Manufacture of Tiles for Draining,	16
12. Tile Draining,	17
13. Management of Sheep with a view to the Improvement of the Pleece,	17
14. Rearing and Fattening Poultry,	18
15. Manufacture of Paper from the Fibre of Indigenous Vegetables,	18
16. The Insects injurious to Vegetation,	19
17. Reservoirs of Water for Agricultural Purposes,	19
18. Points in Cattle indicating Disposition to Fatten early,	20
19. Point in Cattle of the West Highland Breed indicative of Disposition to Fatten,	20
20. Preserving Potatoes,	21
21. Reports on Irrigation,	21
22. Extirpating Ferns from Pastures,	22
23. Reports on Dairy Management in Scotland,	22
24. Reports on Improved Rural Economy Abroad,	23
25. Honorary Premium for an Account of any District in Scotland,	23

EXPERIMENTS AND IMPROVEMENTS.

CLASS I.—WASTE LANDS,	25
1. Honorary Premiums for Improvement of a Specified Extent of Land by Tillage,	25
2. Reclaiming Land from the Sea,	26
3. Reclaiming Land by Embanking Rivers,	26
CLASS II.—CROPS AND CULTURE,	26
1. New Plants adapted to Field Culture,	26
2. Feeding off Turnips by Sheep,	27
3. Early Angus Oats of the greatest weight,	28
4. Ploughing Competitions,	28
CLASS III.—PASTURES,	29
1. Management of Pasture Lands,	29
2. Saving the Seeds of Italian Rye-grass,	29

CLASS IV. LIVE STOCK—DISTRICT COMPETITIONS,	30
§ I. CATTLE,—	
Premiums for Improving the Breed of Cattle in various Dis-	
tricts,	30-37
§ II. WORK HORSES,—	
Premiums for Improving the Breed of Draught Horses in var-	
ious Districts,	37-39
§ III. SHEEP AND WOOL,—	
Premiums for Improving the Breed of Sheep in various Dis-	
tricts,	39-40
§ IV. SWINE,—	
Premiums for Improving the Breed of Swine in various Dis-	
tricts,	40-41
CLASS V. PRODUCTS OF LIVE STOCK,	41
§ I. CURING BUTTER,	41
§ II. MAKING CHEESE,	42
1. Sweet or Full-Milk Cheese,	42
2. Skim-milk Cheese,	43
CLASS VI. COTTAGES,	44
1. Premiums in Money to Cottagers for the Cleanest kept Cottages,	44
2. Medals to Cottagers,	46
3. Premiums to Cottagers for promoting attention to the Cultivation	
and Management of Bees,	47
CLASS VII. WOODS AND PLANTATIONS,	48
1. Honorary Premium for extensive Planting,	48
2. Reports on recent Plantations,	48
3. Native Fir Woods,	48
4. Fir Plantations,	49
5. Collecting the Seeds of the <i>Pinus sylvestris</i> from Native Trees,	49
6. Introduction of New Forest Trees into Scottish Plantations, . .	49
7. Introduction of Forest Trees not yet known in a Living State in	
Scotland,	50
8. More extended Introduction of known Species of the Fir Tribe,	51
CLASS VIII. IMPLEMENTS OF HUSBANDRY AND USEFUL MACHINES,	51
CLASS IX. GENERAL SHOW OF LIVE STOCK AND AGRICULTURAL	
MEETING AT PERTH IN 1836,	52
Cattle—Horses—Sheep—Swine—Wool—Extra Stock,	
Implements, Roots and Seeds,	52-56
General Regulations for the Perth Show,	56-59
CLASS X. GENERAL SHOW OF LIVE STOCK AND AGRICULTURAL MEET-	
ING AT DUMFRIES IN 1837,	60
Cattle—Horses—Sheep—Swine—Extra Stock, Imple-	
ments, Roots, Seeds—Products of Live Stock—Swcep-	
stakes—Wool,	60-65
NOTE REGARDING THE VETERINARY SCHOOL,	66
NOTE REGARDING THE TRANSMISSION OF SPECIMENS OF THE DIFFERENT	
QUARRIES AND MINES OF SCOTLAND,	67

PRELIMINARY NOTICE.

THE business of THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND is conducted by a President, Four Vice-Presidents, Thirty Ordinary, and Ten Extraordinary Directors, a Treasurer, an Honorary Secretary, and a Secretary, to which last all communications are addressed. The Ordinary Directors are subdivided into Committees for the dispatch of business, assisted occasionally by those Ordinary Members most conversant with the subjects to be discussed. The Report of each Committee is brought before the Directors collectively for farther procedure, and these proceedings are again submitted for approbation to a half-yearly General Meeting of the Society. One of the General Meetings is, by the Charter, appointed to be holden on the second Tuesday of January; the other on such lawful day in the months of June or July as the Directors may fix. New members are admitted at either of these General Meetings by ballot. They pay a small annual contribution of £ 1 : 3 : 6, or, in their option, and in full of all future claims, a life-subscription of Twelve Guineas. The Annual Subscription is payable in advance, and is expected to be so paid or remitted, by the Members who are liable in it, without expense to the Society. All Meetings of Directors, or Committees, are open; and at these any member may attend and deliver his opinion on the subjects under consideration, though, in cases of division, the Directors or Members of the Committees only are entitled to vote. Members have access to the Society's Library, which is annually increasing, by the purchase or donation of books connected with the purposes of the Institution.

When the Highland and Agricultural Society of Scotland was instituted in the year 1784, the object chiefly contemplated was the improvement of the Highlands, and hence the name—The HIGHLAND SOCIETY of Scotland—which it then assumed. But the great increase in the number of its Members since that time, the happy management of its funds, and the change in the general state of the country, have long enabled it to extend the design of its first institution, and direct attention to every part of North Britain where industry might be excited or the useful arts improved. In accordance with this extension of the purposes of its institution, the Society, in the Supplementary Charter lately obtained, has been named THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

The Society has, neither by its Charters of Incorporation, nor by its practice, been limited in its patronage to any one department of industry; but it has regarded, as the fitting objects of encouragement, every application of useful labour which might tend to the general good. But although its patronage be thus extended as regards its objects, circumstances have arisen to modify, in some cases, the application of it. The establishment of certain Boards, as for the encouragement of the Herring Fishery, and the like, has induced the Society to restrict its original views, and to devote its attention, and apply its funds, in a more especial manner, to other objects, and chiefly to Agricultural and Rural Economy in their various branches.

In fulfilment of its purposes, the Society is every year accustomed to offer and award a variety of Premiums, as the means of eliciting and diffusing knowledge,

as incitements to industry, or as the rewards for useful undertakings. These relate to every subject which may be supposed to fall within the plan of the Institution:—such are, the Improvement of Waste Lands by Tillage, by Irrigation, or by Draining, the development of the Mineral Products of the country, the extension of Plantations, as the objects of ultimate profit, or of present embellishment and shelter,—the improvement of the breeds of Live Stock, and of the qualities of Wool,—the encouragement of certain domestic Manufactures,—and, not the least in interest and importance, the awakening the Industry of the Lower Ranks to such pursuits as shall promote their content, by ameliorating their condition. A Mechanical Department exists for rewarding the original invention or subsequent improvement of all machines and implements for Agricultural purposes, the construction of those for other branches of Rural Economy, and of some for domestic convenience. Models of these are received and preserved in the Society's Museum: and descriptions of all such as merit attention are as speedily as possible conveyed to the Public.

Although certain subjects be thus selected as the objects of experiment or discussion, the patronage of the Society is not restricted to these objects. Its purposes being the promotion of general industry and improvement, it receives with favour every beneficial communication, and every statement of facts which may admit of an useful application.

The Papers of the Society are printed periodically in "*THE QUARTERLY JOURNAL OF AGRICULTURE, AND THE PRIZE ESSAYS AND TRANSACTIONS OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND,*" published by Messrs BLACKWOOD of Edinburgh, Mr CADELL of London, and Messrs CURRY & Co. of Dublin.

All Communications relating to Premiums, as well as Papers or Reports for publication in the Transactions of the Society, and other subjects for the consideration of the Directors, are to be addressed to CHARLES GORDON, Esq. the Secretary of the Society, at the Society's Hall, Albyn Place, Edinburgh.

NOTICE TO CANDIDATES,

AND GENERAL RULES FOR COMPETITION.

WHEN subjects are specially selected for competition, it is always to be understood, *1st*, That however concisely the subjects themselves be announced, ample information is required concerning them; *2d*, That this information shall be founded on experience or observation, and not on simple references and quotations from books; *3d*, That it shall be digested as methodically as possible; and, *4th*, That Drawings, Specimens, or Models, adapted to a defined scale (3 inches to the foot if convenient), shall accompany writings requiring them for illustration.

Certain conditions are annexed to each of the various subjects of competition, as detailed in the List of Premiums; and these are rigidly enforced by the Society, as the only means of ensuring regularity in the conduct of the business, and of distributing exact justice among the competitors.

In all Essays for competition, it is expected that when facts not generally known are stated, they are to be authenticated by proper references. Competitors in Essays shall not communicate their names, but shall transmit along with the Essays a sealed note containing their names and addresses, and inscribed on the back with some distinguishing motto or device, which shall also be inscribed on the Essay. When this regulation is neglected, such Essay shall not be received in competition. If the Essayist has formerly gained a Premium from the Society for a paper communicated by him, it is recommended that his subsequent Essay shall be written in a different hand from that of the former successful paper.

None of the sealed notes, except those which bear the distinguishing motto or device of the Essays found entitled to Premiums, will be opened, and the sealed note will not in any instance be opened, without the consent of the author, unless a Premium equal to at least one-half of the sum offered shall have been adjudged. But should no application be made for the Paper on or before the 1st of March in each year, it will be held as belonging to the Society on the terms proposed. Such Essays as are not found entitled to any Premium, will, with the sealed notes, be returned to the authors, if required. The Society is to be at liberty to publish the Essays, or extracts from them, for which the Premium, or part of it, shall be awarded.

Candidates are requested to observe, that, in any instance, when Essays, Reports, or Certificates are unsatisfactory, the Society is not bound to give the reward offered; and that in certain cases power is reserved of giving such part only of a Premium as the claim may be adjudged to deserve; but competitors may feel assured that the Directors will always be inclined to judge liberally of their several claims.

In all Reports of Experiments relating to the Improvement or Management of Land, it is expected that the expenses shall be accurately detailed. When Machines or Models are transmitted, it must be stated whether they have been elsewhere exhibited or described.

In all Premiums offered, having reference to Weight or Measure, the New or Imperial Standards are alone to be understood as referred to; and Competitors are required to state their calculations according to these, the only legal standards, otherwise the claim will not be entertained.

When the Premiums are awarded in Plate, the Society will, in such cases as the Directors may see proper, allow them to be paid in money, on the application of the successful Candidates.

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 JAMES HUNTER, Esq. of Thurston.
 JOHN BURN MURDOCH, Esq. of Coldoch.
 JOSEPH MURRAY, Esq. of Ayton.
 THOMAS STEWART TRAILL, Esq. Professor of Medical Jurisprudence in
 the University of Edinburgh.
 Sir JOHN CAMPBELL of Ardnamurchan, Bart.
 JOHN GORDON, Esq. of Cairnbulg.
 JOHN INGLIS, Esq. of Redhall.
 ANDREW MURRAY, Esq. of Murrayshall.
 JOHN DONALDSON BOSWALL, Esq. of Wardie, Captain R. N.
 JAMES CAMPBELL, Esq. of Craigie.
 ARCHIBALD BELL, Esq. Sheriff of Ayrshire.
 ALEXANDER DUNLOP, Esq. Advocate.
 WILLIAM GRIERSON, Esq. of Garroch.
 PATRICK SMALL KEIR, Esq. of Kinmonth.
 JOHN ROBISON, Esq. Secretary of the Royal Society.
 RICHARD CAMPBELL, Esq. of Auchnabreck.
 HENRY MAXWELL, Esq. Merchant, Leith.
 DAVID MILNE, Esq. younger of Milnegraden, Advocate.
 ANGUS FLETCHER, Esq. of Dunans, Advocate.
 ALEXANDER HUNTER, Esq. of Doonholm, W. S.
 JOHN BORTHWICK, Esq. of Crookston.
 JAMES WYLD, Esq. of Gilston.
 COLIN CAMPBELL, Esq. of Jura.
 The Right Hon. CHARLES, LORD GREENOCK.

Chairmen of Standing Committees, 1836.

Funds and Accounts,..... Sir JOHN STUART FORBES, Bart.
Publications and Papers, ... DAVID LOW, Esq. F.R.S.E., Prof. of Agriculture.
Mechanics, JOHN ROBISON, Esq. Sec. Royal Soc. Edinburgh.
Geology,..... The Right Honourable LORD GREENOCK.
The Veterinary School,..... JOHN BURN MURDOCH, Esq. of Coldoch.
Regulations for General Shows of Live-Stock, } G. MACMIKEN TORRANCE, Esq. of Kilsaintninian.
The Argyle Naval Fund,... P. SMALL KEIR, Esq. Kinmonth.

PREMIUMS, &c.

*SOCIETY'S HALL, ALBYN PLACE,
EDINBURGH, 9th Feb. 1836.*

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND does hereby advertise, That the under-mentioned PREMIUMS are to be given by the Society in the year 1836, &c.

ESSAYS AND REPORTS.

1. GEOLOGICAL SURVEYS.

Fifty Sovereigns, or a Piece of Plate of that value, will be given to any person who shall, from actual observation, execute the best Geological Survey of any county or district in Scotland (except Berwickshire and the Lower District of Morayshire, already reported), by colouring accurately, and in the fullest detail that the scale will admit of, a portion of Thomson's Atlas of Scotland (folio edition), corresponding to an extent of surface of not less than 200 square miles, to be lodged with the Secretary on or before the 20th of October in any year.

This Map must be accompanied by a report, giving a full description of the Geology and Mineralogy of the district represented, accompanied by coloured sections of such portions of it as may appear to require this species of illustration, founded on actual observation; if in any case the sections should be ideal, it must be so stated. In this Report the author will be required to explain the classification and subdivision of the different rock formations he may have adopted, and in general to communicate every thing of interest or importance that may occur to him as being connected with the subject of the survey. He will likewise be expected to have paid particular attention to the topography of the county or district included in the survey, so as to be able to point out any errors or omissions he may have

detected in the map ; or should he be able to procure a better survey of the district he is describing than that which is in the collection above referred to, he will be permitted to avail himself of it, provided it is on a scale equally suited to the purpose.

The author is further invited to direct his attention to the relation existing between the nature and fertility of the soil and the **rock formations**, both in reference to agriculture and the growth of timber, and to notice any remarkable or interesting **spring-waters**, particularly in respect to their temperature and to the medicinal or other properties they may appear to possess. If not already sufficiently known, a chemical analysis of such waters as may be considered likely to be of importance, must accompany the Report, together with specimens of the different rocks referred to in the Report, and of their mineral and organic contents,—to be the property of the Society, and placed in its museum.

Farther, for Geological Surveys deemed worthy of distinction, but which may not be found entitled to the principal premium in the year in which they are lodged, the Society's Gold or Silver Medal will be awarded to the authors. And, in order to hold out every encouragement to geologists to assist the Society in the important object of completing geological surveys of the various districts of Scotland, it has been resolved that, should any survey not obtain a premium in the year in which it is transmitted, the author shall be entitled to amend it by farther observation, and to bring it forward for competition in a future year.

The Surveys in competition for this premium in 1836, to be lodged on or before the 20th of October next, under the conditions on pages 5 and 6.

NOTE.—Two Hundred Square Miles being the smallest extent for which the above Premium of Fifty Sovereigns is, under any circumstances, to be awarded, will only be considered sufficient in cases in which the competitors shall have selected for the subjects of their Surveys and Reports, those districts which, from the variety or the complexity of the geological formations, and the importance of the mineral resources they contain, possess the greatest degree of public interest, and, at the same time, require the most time, labour, and talent, to describe with the minuteness and accuracy expected.

It must, therefore, be distinctly understood, that the Maps and descriptions of less interesting parts of the country in which a more uniform geological structure, and a greater sameness of mineral character are found to prevail, will not be entitled to that pre-

mium, unless they shall comprehend such an increase in the number of square miles beyond the minimum extent above specified, as the Directors may judge to be fairly proportioned to the circumstances of the case in these respects, and to the comparative facility with which the work may consequently appear to have been performed.

2. REPORTS ON COAL DISTRICTS.

Thirty Sovereigns, or a Piece of Plate of that value, will be given for the best Geological and Mineralogical Report upon any Coal District in Scotland, with the exception of those situated in the south-east part of the county of Fife, which have already been reported upon.

In these Reports it is expected, that, besides a general description of the district, the principal shaft sections shewing the regular order of superposition and succession, as well as the thickness of the different strata, together with their lines of bearing, the direction and degree of their dip, and their organic contents, shall be carefully noticed and accurately detailed. The occurrence of faults or other disturbances, their direction, and the effects occasioned by them on the adjacent strata, must also be particularly noticed, specifying whether or not they appear to have been caused by the presence or intrusion of trap (whinstone) rock, the nature, situation, and extent of which must, in all cases, be specially described, whether they occur only as dikes, or forming more considerable overlying masses. Limestone, iron, or any other profitable mineral productions, met with in the district, must likewise be specially noticed.

Each Report must be accompanied by a general map or plan of the district, and coloured sections taken through such parts of it as may best serve to illustrate the above details (which must not be speculative, but in every case founded on actual observation), and also by specimens of the most remarkable varieties of organic remains, especially those containing portions of fishes, teeth, scales, bones, &c., to be the property of the Society.

Reports for the First Competition to be lodged on or before 20th October 1836, under the condition on pages 5 and 6.

No report will be entitled to this premium unless the whole of the above conditions shall have been strictly fulfilled; and its merits will be estimated more with reference to the amount and value of the information given than to the extent of country described.

The Society's Gold or Silver Medal will be given, according to their value and extent, for such Reports on Coal Districts as may be found worthy of that distinction, but which may not be considered to be entitled to the principal premium, provided they are lodged with the Secretary by the time specified.

NOTE.—The Society takes this opportunity of pointing out to the Proprietors and Managers, and other individuals employed in Coal Works, how much they have it in their power to contribute to the advancement of science, by noticing and preserving the organic remains that have been or may be found in the coal fields with which they are respectively concerned. The fossil remains of plants, shells, crustacea, and fishes, are most commonly met with in limestone, slate-clay, bituminous shale or blaes, and in the nodules and bands of ironstone; but it is earnestly recommended that the miners should be directed to lay aside, and to preserve as entire as possible, every extraneous substance of unusual form and appearance, which they may find in any of the beds in which they are working.

The Society will at all times most thankfully receive communications on this subject, accompanied by specimens, and will confer Honorary Premiums upon those individuals who may most distinguish themselves by their intelligence, zeal, and diligence, in bringing important and interesting discoveries of this nature to its notice.

3. IMPROVEMENTS ON THRASHING MACHINES.

Thirty Sovereigns, or a Piece of Plate of that value, will be given for the best and approved Essay on the Construction of the Thrashing Machine.

The writers are required to state their opinions regarding the best moving power, whether wind, water, steam, or horses, and to give their reasons for preferring one or other of these powers in any given circumstances; and they are required to give such information as their experience enables them with regard to the application of these different moving powers.

Competitors must give such descriptions and illustrations by drawings, as may be necessary to enable the Committee to judge of the improvements or alterations proposed, and to put it in the power of machine-makers to adopt them. A detailed specification of the points to which intending competitors are recommended to direct their attention, may be had on application to the Secretary of the Society, with whom the Essays in competition for the Premiums must be lodged on or before the 20th October 1836, under the conditions on pages 5 and 6.

4. INFLAMMATORY COMPLAINTS OF FARM-HORSES.

It being understood that Farm-Horses generally, are more sub

ject to diseases of the bowels than those employed in posting and such work,

Ten Sovereigns, or a Piece of Plate of that value, will be given for the best and approved Essay on the causes of the greater liability of Farm Work-Horses, and those employed in heavy draught, to diseases of the stomach and bowels, than horses employed in posting or coaching, or other fast-work, and the best means of preventing and curing those diseases.

Essays to be lodged on or before 20th October 1836, under the conditions on pages 5 and 6.

5. FEEDING OF FARM-HORSES ON RAW AND ON PREPARED FOOD.

Twenty Sovereigns, or a Piece of Plate of that value, will be given for the most detailed and satisfactory account of keeping Farm-Horses on the food usually given to them, and in the usual manner, in comparison with the same or different food in a prepared state.

The competitors are at liberty to give any kind of food, and in any proportion they please; but the exact quantity and proportion given are required to be distinctly stated. The criterion by which to judge of the comparative feeding properties of the food is the working condition of the horse, in relation to the quantity and nature of work performed. Certificates of this comparative working condition, signed by two members of the Society, must accompany the Essays. In order to preserve a uniformity in the comparative expense of feeding in the various ways, competitors are recommended to calculate the value of the articles, and at the following prices, viz. Hay 3d., straw 2d. per imperial stone of 14 lb.; oats 3s., beans 5s., barley 3s. 6d. per bushel; fine barley dust 10d. per imperial stone; potatoes 7s. 6d. per boll of 5 cwt.; salt 2s. 6d. per cwt.; coal 10s. per ton; men's wages 1s. 6d., and women's 10d. per day.

Essays and certificates to be lodged with the Secretary on or before the 20th day of October 1836, under the conditions on pages 5 and 6.

6. FEEDING OF OTHER LIVE-STOCK.

Twenty Sovereigns, or a Piece of Plate of that value, will be given for the best account, founded on experiment, of the employment of substances, other than the common produce of the farm, in the feeding of Live-Stock.

The substances on which experiments may be made are Oil-cake, Rape-cake, Malt-dust, Brewers and Distillers' Refuse, Sugar

Molasses, or any other nutritive food. The animals put up to feed shall not be fewer than three Oxen for each kind of food on which the experiment is to be made. The live weight of these oxen at the time of being put to feed must be determined, and compared with that of an equal number of oxen put up to feed on the common provender of the farm, as straw and turnips, hay and turnips, and the like; or if the time of feeding shall be summer, on grass used as herbage, or cut for soiling. The live, or if possible the dead, weight of both classes of animals, must be ascertained on the conclusion of the period of feeding; the quantities of the food used in the experiment must be specified, and a calculation given of the expense of the two kinds of feeding. The quality of the meat to be stated when the competitor has it in his power to do so.

It is not intended that the animals fed on the substances to be experimented upon, as the oil-cake, malt-dust, &c. shall be fed solely on that food, but that they shall receive such a portion of it as shall render the experiment satisfactory and decisive. It will be held as complying with the conditions of the premium, that the lot of oxen put up to feed shall be three; but it will be regarded as adding to the interest and importance of the experiment, that more lots than one are put to feed on separate kinds of food, to be compared with the lot feeding on the common provender of the farm. Farther, though the premium is here offered for feeding oxen, and it is an essential condition that one lot of three oxen shall form the subject of experiment, yet it will be considered as rendering the experiment more complete, that similar experiments are made with other kinds of animals, as sheep and hogs.

Reports to be lodged on or before the 20th October 1836, under the conditions on pages 5 and 6.

7. COMPARATIVE EXPERIMENTS ON THE FEEDING OF STOCK IN CLOSE HOUSES AND IN OPEN SHEDS OR HEMMELS.

The manner of feeding Stock in small numbers, as two or four, in covered sheds with yards, commonly termed *hemmels*, having been long introduced and greatly approved of by the most eminent breeders in the north of England and south of Scotland, it is desirable to induce agriculturists to institute experiments on these two methods of feeding. The Society, therefore, offers the Gold Medal, or Ten Sovereigns, to the person who shall report any set of satisfactory experiments with Oxen fed in hemmels, as compared with a similar number fed in stalls in the house. The period of feeding must not be less than Four Months, the number of cattle shall

not be less than Six, and the number put up in each hemmel must not exceed Two; the sex and ages of those put up in the hemmels and in the stalls must be the same, the quality of the stock as nearly as possible similar, and the same kind of feeding must be given.

Reports to be lodged on or before the 20th of October 1836, under the conditions on pages 5 and 6.

8. PRUNING OF FOREST TREES.

Ten Sovereigns, or a Piece of Plate of that value, will be given for the best and approved Essay on the pruning of Forest Trees.

It will be required that the Essay embrace the question, Whether the pruning of Forest Trees in general is beneficial or hurtful to the growth and value of the timber? Whether any particular species of trees are improved by pruning, and what species are liable to be injured thereby? How pruning affects the general growth of the tree, and the parts of the trunk in the immediate vicinity of the wound made by pruning, and what periods of the season are most suitable for pruning the different species of trees?

It is desirable that the author shall keep in view the generally received doctrines of vegetable physiology, particularly regarding the circulation of the sap, its ascent and descent, and its elaboration in the leaves, in that process. He will also be expected practically to detail the modes and extent of pruning best suited to the various kinds of Forest Trees in their different stages of growth, and in different soils and situations, and also to indicate any peculiar mode of pruning, where something beyond mere increase of bulk is aimed at, such as bent timber for naval purposes.

It being understood that in some parts of the country experiments have been made by pruning every alternate tree in rows of the same species, the results of such experiments should be stated. It will be desirable that the author ascertain correctly the marketable value with ship-builders, house-carpenters, and other consumers of timber, of trees which have been pruned and have stood detached (as in the hedge-rows of England), compared with those which have grown in the forest without pruning.

Although it is not specially required, yet it may not be beyond the object of the Essay, to point out how far Forest Trees, either single or in mass, may be by the operations of pruning improved or injured, in regard to their beauty or picturesque effect, and how far some kinds might be improved by grafting other rarer or more showy kinds upon them.

The Essays to be lodged with the Secretary on or before the 20th October 1836, under the conditions on pages 5 and 6.

9. IMPROVEMENT OF FLAX MILLS.

Ten Sovereigns, or a Piece of Plate of that value, will be given to the person who shall describe, in the most satisfactory manner, an improved method of effectually breaking and scutching flax with machinery.

Essays, with Models (on a scale, where convenient, of three inches to the foot), and with illustrative drawings of the improved machinery, to be lodged with the Secretary on or before the 20th day of October 1836, under the conditions on pages 5 and 6. Should any of the machinery described be in actual operation, a quantity of the flax broken and scutched, of half a stone each, must be transmitted for inspection along with the Essays.

10. IMPROVED METHOD OF MAKING HAY.

The method of making hay which prevails in Scotland being generally acknowledged to be injurious to its nutritive properties, Ten Sovereigns, or a Piece of Plate of that value, will be given to the person in Scotland who shall describe, in the most detailed and satisfactory manner, that method of making hay, whether of meadow or artificial grasses, founded on his own experience, which has secured the crop under every circumstance of weather, in the shortest time, and in the most nutritious state.

The competitor must state the mixture of plants, and the period of their growth when cut down, whether in meadow or arable rotation, which, in his opinion, will make the most nutritious hay—the time occupied in making—and whether it is expedient to use salt, and in what quantity.

Certificates, signed by two members of the Society, of the condition and quantity of the hay made as described, to be transmitted along with the essay, and both to be lodged with the Secretary on or before the 20th day of October 1836, under the conditions on pages 5 and 6.

11. MANUFACTURE OF TILES FOR DRAINING.

The Gold Medal, or Ten Sovereigns, will be given for the best Essay on the Economical Manufacture of Tiles and Tile Soles for Drains.

The attention of the writer is specially directed to the best form of kiln—the machinery and implements calculated to abridge labour in the manufacture—the shape and size of tiles and soles—the quality of clay most suitable, and the method of preparing it—the process of firing—with a detailed account of the expense of the different stages of the process, and at what prices tiles and soles can be sold by the manufacturer.

There is reason to believe that drain tiles of good quality are made in the county of Huntingdon, at an expense not exceeding 14s. per thousand; while in Scotland, under the most favourable circumstances, the cost has hitherto much exceeded that sum.

Essays to be lodged with the Secretary on or before the 20th October 1836, under the conditions on pages 5 and 6.

12. TILE DRAINING.

A Piece of Plate, or Ten Sovereigns, will be given for the best Essay on Tile Draining.

It is expected that the Essay shall describe the proper shape and size of the tile, and whether it should have holes in the crown and sides or not—the size of tile called a *sole*, and best shape—the form and depth of drains, with their distance from each other, having reference to the varieties of soil—the greatest declivity at which drains may be made with perfect safety, and how near to a dead level they may be carried—the best direction of drain, whether in the furrow or crown of the ridge, in the direction of the slope or not—where a sole is requisite and where not—what material best and most economical for covering the tiles—whether the vegetable mould only should be used in filling the trench above the tile, or may the subsoil be safely used, and if not, how ought it to be disposed of—at what depth from the surface should the crown of the tile be placed—the best way of finishing drains at the ends—should they be carried into a Main Drain, and if so, should the main drain be filled up with stones, or will an extra-sized tile be equally safe and permanent—if a common sized tile be too small, is an extra-sized one recommended, or will two ordinary ones be preferable, and if so, how ought they to be placed in the drain—what time should be given to consolidate the covering of the drains before horses are permitted to pass over them—the comparative advantages and disadvantages of draining with tiles or stones—with such other information as may appear to the writer deserving of notice.

Essays to be lodged with the Secretary on or before the 20th October 1836, under the conditions on pages 5 and 6.

13. MANAGEMENT OF SHEEP WITH A VIEW TO THE IMPROVEMENT OF THE FLEECE.

Twenty Sovereigns, or a Piece of Plate of that value, will be given to the person who shall communicate to the Society the best and approved Essay, founded on experience or personal observa-

tion, on that mode of treating Sheep, whether of the Leicester, Cheviot, or Black-faced breed, which shall insure the greatest quantity of Wool, of the finest quality; and describing those properties of Wool by which its quality may be most easily judged of.

In treating this subject, the Essayist will be required to describe in a particular manner, the treatment of Tups throughout the year—the treatment of Ewes, from the period of tupping to that of lambing—the treatment of Ewes and Lambs till the period of weaning—the treatment of Ewes from the time of weaning to tupping time—the treatment of Hoggis in the autumn, and during winter—the best mode of washing wool, whether off or on the sheep's back, and of clipping it—the best method of rolling up and preserving the fleece for a length of time, and the best method of packing it. It is desirable that the Essayist should express his opinion of the effects of climate, situation, and food on the wool of sheep.

Essays to be lodged on or before the 20th October 1837, under the conditions on pages 5 and 6.

14. REARING AND FATTENING POULTRY.

To the person in Scotland who shall have reared and fed for sale the largest quantity of Poultry of the Dorking breed, between the 1st of March 1836, and the 1st of September 1837, the Silver Medal or a sum in money, as the Directors may see fit in the circumstances of the case.

Competitors are required to transmit to the Secretary, on or before the 20th of October 1837, a Report detailing generally the system they may have adopted in rearing and feeding the Poultry, and an affidavit that the numbers returned in claim for the premium were of the Dorking breed; a certificate by a member of the Society resident in the neighbourhood, in support of the matters detailed in the Report, must be transmitted therewith.

15. MANUFACTURE OF PAPER FROM THE FIBRE OF INDIGENOUS VEGETABLES.

The Honorary Silver Medal, or a Piece of Plate, as the Directors may see fit, will be given for an account of the best set of experiments on the economical employment of the Fibre of Indigenous Vegetables in the Manufacture of Paper, particularly of such as may be obtained in great quantity at little cost—as pease straw, potato haulm, spent bark, &c.

Reports, with specimens of the Paper, to be lodged with the Secretary, on or before the 20th of October 1837, under the conditions on pages 5 and 6.

16. THE INSECTS INJURIOUS TO VEGETATION.

Twenty Sovereigns, or a Piece of Plate of that value, will be given for the best and approved account of the Insects peculiarly injurious to the Plants usually cultivated in this country, with a scientific detail of their transformations, habits, and mode of breeding.

It is required that the Essay be the result of personal observation, that the species of Insects be correctly named and described, according to the recent Entomological Systems, and that the nature of the damage caused by them be explained with reference to the texture and physiology of the plant attacked; with suggestions, grounded on experiment, of the best modes of preventing or checking their ravages. Specimens if possible, or correct drawings, of the Insects in all their states are required; and it is recommended that the observations be arranged to have reference to Cereal Plants, Green Crops, Culinary Vegetables, Fruit-Shrubs, Fruit-Trees, and Forest-Trees.

It is, of course, expected that diseases caused by attacks of Insects be properly distinguished from those arising from bad soil, &c. rendering plants liable to be injured by Insects, and that the treatment in both cases will be given on accurate principles.

The Essays to be lodged with the Secretary on or before the 20th October 1837, under the conditions on pages 5 and 6.

17. RESERVOIRS OF WATER FOR AGRICULTURAL PURPOSES.

The Gold Medal will be given for the best and approved Essay on the most effectual method of constructing Reservoirs of Water for Agricultural purposes, such as the impulse of Mills and Machinery, supplying a Farm with water during summer, irrigation, or other objects.

In the Essay, the various parts of the Reservoir should be minutely specified, such as, 1. Mason work, the cements used therewith, and the sizes, shapes, and qualities of the stones. 2. The Puddle, its quality, thickness, and how prepared and applied, whether in conjunction with masonry or not. 3. The gravel, cement, or other means of securing the puddle from the inroads of water, rats, and other animals. 4. The slopes of the breast-work on both sides, and quality of materials composing it, and the mode of securing that on the water-side from the operation of the waves or other casualties. 5. The mode of founding the masonry, the puddle, and the embankment, and the necessary precautions for securing them in the various strata which usually occur. 6. The best modes of carrying off the surplus water, especially when a foundation of rock cannot be

obtained for the waste channel. 7. The best construction of the necessary sluices for the regulation of the supply of water to be given out of the reservoir; and, 8th, Any other particulars that may be of use for securing the perfect safety of the work. It will also be desirable that the laws which regulate the pressure of water, in relation to its depth, be explained in a manner as clear and familiar as possible. The quantity of rain which falls during the season, on a given surface, in places where rain gauges have been kept, may also be stated. Essays to be lodged on or before the 20th October 1837, under the conditions on pages 5 and 6.

18. POINTS IN CATTLE INDICATING DISPOSITION TO FATTEN EARLY.

With a view to direct attention to the comparison of points in animals that have fed kindly, and attained weight early, with the same points in animals that, under similar circumstances and treatment, have not thriven so well,

The Gold Medal, or a Piece of Plate of such value as the Directors may think fit, in the circumstances of the case, will be given to the person who shall transmit to the Society the result of the greatest number of experiments on different breeds of neat cattle, made with the view of ascertaining whether there be any peculiarity of anatomical structure which indicates a constitution in such cattle disposing to fatten early.

Reports detailing every interesting particular bearing on the results, to be lodged on or before the 20th October 1837, under the conditions on pages 5 and 6.

19. POINT IN CATTLE OF THE WEST HIGHLAND BREED INDICATIVE OF DISPOSITION TO FATTEN.

It having been represented, as the result of careful observation of cattle of the West Highland breed, that when the distance from the hough to the hoof is short, and consequently the length from the hip to the hough is relatively long, the animal having such a point is to be preferred to one that has a longer foot and shorter leg, the Society, desirous that this very prominent point should be established, supposing the observations already made to be correct, offers the following Premium:—Should any prominent configuration of any part be ascertained to indicate a constitution disposed to fatten, the choice of stock, and the selection of calves for rearing, will be greatly facilitated,

The Gold Medal, or a Piece of Plate of such value as the Directors may think adequate, will be given to the person who shall

select not fewer than six Oxen of the West Highland breed, under similar circumstances, three with short, and three with long feet, and feed them nearly in the same manner, and exhibit them, after having been so fed, at the Society's General Show of Live Stock at Glasgow in 1838.

It may be observed, that many animals, as the ox, anatomically speaking, walk on their toes, hence from the hough to the hoof is properly the foot.

20. PRESERVING POTATOES.

Ten Sovereigns, or a Piece of Plate of that value, will be given for the best and approved account, founded on experience, of the most successful method of preserving Potatoes in good condition, in their natural state, for a period of not less than ten months from the time of their being taken up.

Competitors are required to communicate their experience as to the superiority of any of the methods now in practice, viz. securing the potatoes in covered heaps upon the surface, in pits, in houses, vaults, cellars, or otherwise.

Very opposite opinions seem to be held on the advantages of pitting or storing in out-houses or cellars, and also as to the general temperature which should be aimed at, some recommending from 35° to 40°, and others from 50° to 60° Fahr. Where pitting is preferred, there appears to be a difference of opinion as to the proper depth of the pits, and as to the thickness of the covering; likewise, whether the heap should be kept in a dry or damp state generally, and as to the utility of placing either a layer of dry straw or dry fern, or of green sprats or fresh turf, between the potatoes and the earthy covering, or of employing no other covering than the dry soil. Competitors are required to state their views on all these topics, and also, as to what extent the preserving character of potatoes depends on innate qualities in the tubers, or on the mode of preservation employed; and it is desirable that the names and descriptions of the different varieties of the potato that appear better adapted than others for long keeping, should be mentioned.

Reports to be lodged with the Secretary, on or before the 20th October 1838, under the conditions on pages 5 and 6.

21. REPORTS ON IRRIGATION.

Ten Sovereigns, or a Piece of Plate of that value, will be given for the best and approved account of the Management of Water

Meadows, founded on actual experiment, within three years preceding the date of the Essay.

The experiments to be made on not less than five acres, whether detached or otherwise, and a description to be given of the rills or streams employed, and of the quality of the water, and of the manner of collecting and applying it; also an account of the land prior to the introduction of irrigation upon it, and of its estimated value at that period, and at the time when the Report is made; certified statements to be made of the quality of grass, if any, cut green in the spring, and the quantity and quality of the hay and aftermath produced upon the portion reported on, and the kind of stock, if any, which has been allowed to depasture it.

The Essays, accompanied by a specimen of the hay produced that season, to be lodged with the Secretary, on or before 20th October 1839, under the conditions on pages 5 and 6.

22. EXTIRPATING FERNS FROM PASTURES.

Fifteen Sovereigns, or a Piece of Plate of that value, will be given for the best and approved account, founded on experience, of a cheap mode of eradicating Ferns from Pastures, and particularly from hill pastures, where the plough cannot be employed.

The extent of ground subjected to the experiment must not be less than twenty acres; the Report must state about what proportion of the surface was occupied by the ferns, with the expense per acre incurred in their eradication, and must be lodged with the Secretary, accompanied by specimens of the ferns destroyed, on or before the 20th October 1840, under the conditions on pages 5 and 6.

There is evidence in favour of the belief that the object in view may be accomplished by repeated irrigation of the ground; also, that repeated cutting of the ferns while young and succulent, thus preventing their bringing their tops to perfection, during the whole season, or two consecutive years, will destroy them. It is desirable that the truth of these opinions should be established or refuted, and any other successful mode of treatment pointed out.

23. REPORTS ON DAIRY MANAGEMENT IN SCOTLAND.

To the person who shall, on or before 20th of October in any year, transmit to the Society the best Report on the Management of a Dairy, of not fewer than ten cows, in any district in Scotland—the Society's Silver Medal, or a Piece of Plate, as the Directors may see fit in the circumstances of the case.

The Report will detail the mode of Management in the Dairy which forms the subject of the communication ; the description of pasture, and general treatment of the cows ; whether butter or cheese forms the staple produce ; the process of manufacture, and how disposed of ; if cheese, the kind or kinds made ; description of the milk and cheese houses, and of the utensils ; with any other circumstances that may appear material.

24. REPORTS ON IMPROVED RURAL ECONOMY ABROAD.

The Honorary Gold or Silver Medal of the Society will be given for the best accounts, founded on personal observation, of any useful practice or practices in Rural or Domestic Economy adopted in other countries, which may seem fitted for being introduced with advantage into Great Britain.

For the most approved communication under this head, which shall be rendered on or before the 20th October in each year, the Society's Honorary Gold Medal will be awarded ; and for all other Communications in the same year, which shall be approved of, the Society's Honorary Silver Medal.

However advanced the state of the Useful Arts may be considered in this kingdom, it is not to be doubted that there are many practices in use, both of domestic and rural economy, in other countries, and particularly in France, the Low Countries, and the north of Germany, highly deserving of attention or imitation, and which yet are too apt to be disregarded or unnoticed by the traveller or casual resident. The purpose chiefly contemplated by the offer of the present premium is to induce gentlemen, who may visit other countries, to take notice of and record such particular practices as may seem calculated to benefit their own country in the branches of the arts referred to ; and it is proposed that the earliest opportunity shall, in all cases, be taken of communicating such details to the public.

25. HONORARY PREMIUM FOR AN ACCOUNT OF ANY DISTRICT IN SCOTLAND.

To the person who shall, on or before the 20th of October in any year, furnish to the Society the best Account of any District in Scotland, with reference to the present state of Husbandry, and the progress of rural and general improvement—The Society's Silver Medal, or a Piece of Plate, as the Directors may see fit in the circumstances of the case.

The report is expected to be given from the writer's experience or observation, and the extent of the district reported upon is not to be less than fifty square miles.

In describing the present state of Husbandry, the writer is required to advert to the general character of the soil and surface—to point out any connexion which may be observed to exist between the nature of the soil and substrata, with the progress of the different species of trees planted thereon; also to direct attention especially to the more recent improvements that have been made, or that may be in progress, in the modes of tillage, the breeds of stock, the state and management of roads, the progress of plantations, and the like; and generally, to offer such suggestions as may admit of practical application, regarding the future improvement of the district.

The same premium will likewise be given under this head, for an Account of Districts containing Coal Fields, with special reference to an economical and statistical description of the nature, extent, and other circumstances of the fossil fuel they afford, specifying the position and extent of the coal fields, the peculiarities by which they may be distinguished, whether wholly or partially worked at the present time, or at what former periods? In the latter case, the reason of the work being abandoned or suspended must be stated. The number of persons, men, women, and children, usually employed in the different collieries; the quantity and varieties of coal these collieries afford; the comparative value of each as fuel; the proportion the demand for them bears to the supply; where or in what manner they are chiefly disposed of; and the price the different qualities of coal bear at the pit mouth. The author must also give a conjectural opinion as to the quantity of coal still remaining in the ground, within the district, founded upon the best data he may be able to obtain; from which some idea may be formed of the probable duration of the supply of fossil fuel from these sources, and to communicate generally any useful information on these subjects he is able to give from authentic sources, particularly as to the condition of the working classes, and the means that may be suggested for its improvement.

CONDITIONS OF COMPETITION.

The conditions of competition for Essays and Reports will be found under the "Notice to Candidates" on pages 5 and 6, and to which Competitors are particularly referred.

The specimens of Mines, Quarries, &c. may be lodged at the Society's Hall at any period. The Essays and Reports on subjects 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12, are to be lodged on or before the 20th October next 1836; those on subjects 13, 14, 15, 16, 17, and 18, by 20th October 1837; those on subjects 19 and 20, by 20th October 1838; on subject 21, by 20th October 1839; on subject 22, by 20th October 1840; and Reports on subjects 23, 24, and 25, by the 20th October in any year.

EXPERIMENTS AND IMPROVEMENTS.

CLASS I.

WASTE LANDS.

I. HONORARY PREMIUMS FOR IMPROVEMENT OF A SPECIFIED EXTENT OF LAND BY TILLAGE.

(1.) To the Proprietor or Tenant in Scotland who shall, on or before the 20th October in any year, transmit to the Society a satisfactory Report of his having, within the period of five years immediately preceding the date of his communication, successfully improved and brought into profitable tillage, an extent of waste and hitherto uncultivated Land, not being less than one hundred acres—The Gold Medal.

The Report may comprehend such general observations on the Improvement of Waste Lands as the writer's experience may have led him to make; but it is required to refer especially to the land reclaimed (which if not in one continuous tract, must be in fields of considerable extent), to the nature of the soil, the previous state of the ground, the obstacles opposed to its improvement, the mode of management adopted, the expense, and, in so far as can be ascertained, the produce and value of the subsequent crops; and the land must have borne one crop of grain, at least, previous to the year in which the report is made. The report must be accompanied by a detailed statement of the expense, and by a certified measurement of the ground. Competitors will also attend to the usual General Conditions on pages 5 and 6.

(2.) To the Tenant in Scotland who shall, on or before the 20th October in any year, transmit to the Society a satisfactory Report of his having, within the period of three years preceding the date of his Report, successfully improved and brought into profitable tillage, an extent of waste and hitherto uncultivated land, not being less than thirty acres, on the same farm—The Honorary Silver Medal.

The honorary premium for this more limited extent is offered under the same conditions as that for No. I. of this class; but competitors will observe, that, having gained the Silver Medal, it shall not afterwards be competent to include the same improvement in a subsequent claim for the Gold Medal.

Reports detailing particulars, as required in reference to the premium No. I. of the class, accompanied by a certified measure-

ment of the ground, to be transmitted to the Society before the 20th October in any year, under the conditions in pages 5 and 6.

2. RECLAIMING LAND FROM THE SEA.

To the Proprietor or Tenant in Scotland, who shall, on or before the 20th of October in any year, transmit to the Society a satisfactory report of his having, within the period of five years immediately preceding the date of such report, reclaimed from the sea an extent of not less than five acres of land, or having converted into pasture an extent of not less than five acres of barren ground, periodically overflowed by the sea. The expense and mode of improvement to be accurately detailed, and the returns such as to hold out a reasonable prospect of remuneration—The Honorary Silver Medal, or a Piece of Plate, as in the opinion of the Directors the improvement may be held to deserve. Competitors will attend to the General Conditions on pages 5 and 6.

3. RECLAIMING LAND BY EMBANKING RIVERS.

For the most satisfactory Report of the Embankment of a River in Scotland, causing a profitable addition to or amelioration of the neighbouring lands, in consequence of securing them from the effects of inundations to which they had been previously subject—The Silver Medal, or a Piece of Plate of such value as the communication may be adjudged to deserve. Competitors will particularly attend to noticing any effectual means which may have been adopted for preventing the inroads of moles or other vermin, into the embankment.

Reports to be lodged by the 20th of October in any year, under the conditions on pages 5 and 6.

CLASS II.

CROPS AND CULTURE.

1. NEW PLANTS ADAPTED TO FIELD CULTURE.

To the person who shall, on or before the 20th October in any year, report to the Society any new species or variety of useful Plant adapted to the ordinary field culture of Scotland—The Silver Medal, or a Piece of Plate, as the Directors may see fit, in the circumstances of the case.

Satisfactory evidence will be required that the plant produced is new in the cultivation of the country, either as regards the species or variety, valuable as regards the uses to which it may be applied, and congenial to the soil and climate of Scotland. A particular detail of the discovery or circumstances which led

to the experiment must be furnished, the mode of culture described, and a specimen of the plant transmitted; with such suggestions as to the probable value of its straw, as experience may have enabled the competitor to afford.

2. FEEDING OFF TURNIPS BY SHEEP.

As the practice of feeding off Turnips on the ground by Sheep may be advantageously introduced into those districts of Scotland which are suited to it, and where it has not been generally adopted, the Society offers the following Premiums in the districts after-mentioned.

1. *The County of Ayr;*
2. *The Counties of Moray and Nairn;*
3. *The County of Sutherland.*

To the Farmer in each of the said three Districts, who, in the year 1835, shall have cultivated, in drill, the greatest extent of Turnips, not being under ten acres, in proportion to the extent of land kept under a regular system of rotation, and of which at least one-half shall be eaten off the ground by the feeding of sheep, carefully and regularly inclosed with hurdles or nets, and upon land well adapted to the purpose—Ten Sovereigns.

To the Farmer in each of the said three Districts, who shall have cultivated and fed off the next greatest proportional extent, as aforesaid, not being less than four acres—Five Sovereigns.

In any portion of the field reserved to be fed off by sheep, the blanks left by the turnips removed shall not exceed five drills, so as the benefit of this mode of feeding, arising from the treading and manure of the stock so fed, may be distributed over the whole of such portion.

Competitors for the Premiums in each District will transmit to the Secretary of the Society, on or before 10th November 1836, an affidavit, specifying the extent of their farms under a regular system of rotation, the extent under turnips in 1835, the kind or kinds raised, the proportion fed off by sheep, the manner in which it was done, and within what period; description of sheep so fed, and whether they were the claimant's own stock, or were sent for feeding by another; and, in the last case, the price obtained per acre, will be stated. The affidavit to be accompanied by a certificate of two Members of this Society, in support of the matters therein detailed.

The practice of feeding off turnips by sheep being already introduced among the larger class of farmers in the Second or Mo-

rayshire District, the competition for the Premiums in that District is limited to tenants occupying farms not exceeding 140 arable imperial acres.

3. EARLY ANGUS OATS OF THE GREATEST WEIGHT.

The District of Strathspey, comprehending the Parishes of Cromdale and Inverallan, Abernethy, Kincardine, and Duthill, in the Counties of Moray and Inverness.

To the Tenant in the above District who shall raise the heaviest early Angus Oats, not weighing less than 40 lb. per Imperial bushel, upon any farm within the district, crop 1836—Seven Sovereigns.

To the Tenant who shall raise the second heaviest early Angus Oats in the said district as aforesaid—Three Sovereigns.

To the Tenant who shall raise the third heaviest early Angus Oats in said district as aforesaid—Two Sovereigns.

The quantity raised by each competitor not to be less than fifteen imperial quarters, to be weighed between the 20th November and 10th December 1836; the weight to be the imperial standard. The measure and weight to be ascertained in the presence of, and certified by, a Member of the Society or a Justice of the Peace, whose certificate shall be accompanied by the affidavit of the persons who actually weighed the grain. If the weight shall in any case be equal, the tenant who has the largest quantity to receive the Premium.

The certificates and affidavits, with samples of the oats, not under half a pound, to be lodged at the Society's Hall on or before the 20th of December 1836.

4. PLOUGHING COMPETITIONS.

Premiums to Ploughmen for improvement in ploughing having for some years been given very generally over the country by the resident gentlemen and local Farming Societies, the Highland and Agricultural Society has, in the mean time, discontinued them; but being desirous of encouraging improvement in this branch of husbandry, the Society will give its Silver Plough Medal to the Ploughman found to be the best at such competitions, provided not fewer than fifteen ploughs shall have started, and that Premiums in money to an amount not less than three sovereigns shall have been awarded. The Medal will be issued upon a Report from one or more Members of the Society, who shall have actually attended the competition, stating the number of ploughs that had started, the

number and amount of the Money Premiums awarded, and that the Ploughman found to be the best had not received the Society's Medal at a previous competition in the same district.

The Report must be lodged with the Secretary, at the Society's Hall, within three months after the competition, otherwise the Medal will not be issued.

CLASS III.

PASTURES.

1. MANAGEMENT OF PASTURE LANDS.

The Gold Medal, or a piece of Plate of the same value, will be given to the proprietor or tenant in Scotland, who shall, on or before the 10th of November in any year, report to the Society the most successful management of Pasture Lands, founded on practice.

The land, forming the subject of the report, must have been pastured for at least three seasons, exclusive of that in which the report is given in, and the extent of ground must not be under ten acres. If the land has been sown down within a period of eight years previous to that in which the report is made, the reporter will be required, besides stating the mode adopted in laying down, and the kinds and quantities of seeds used, to give a correct detail of the management from the period of sowing until the land be sufficiently consolidated for the purpose of being depastured. In any case, the reporter will be required to state the kind and quality of the soil, with its exposure and elevation, the mode of drainage, and the various proportions of grasses and other plants constituting the pasture; the means which have been employed in maintaining or increasing the productiveness of the herbage by top-dressing or otherwise. The description of stock grazed, and the modes which have been found most successful in practice of preventing or destroying the growth of the musci, and other plants injurious to the pasture. Competitors are referred to the General Conditions, pages 5 and 6.

2. SAVING THE SEEDS OF ITALIAN RYE-GRASS.

From the increasing cultivation of Italian Rye-grass in this country, and it being found that its seeds may be equally perfected in Scotland, as in those parts of the Continent from which the chief supply has hitherto been obtained, the Society is induced to offer the following Premiums :

Ten Sovereigns, or a Piece of Plate of that value, will be given to the person in Scotland who, during the seasons 1835 or 1836, shall have saved the largest quantity, of good quality, of seed of the Italian Rye-grass.

To the person who shall have saved the second largest quantity of good quality—Five Sovereigns.

Reports, detailing the mode adopted, accompanied by satisfactory evidence that the quantity saved has not been less than fifty bushels, with samples of the seed, to be lodged with the Secretary, at the Society's Hall, on or before the 10th November 1836. Competitors are referred to the General Conditions, pages 5 and 6.

NOTE.—The Society's Seedsman will give the highest wholesale prices to the successful candidates, to the extent of One Hundred Bushels, and he will treat with competitors generally for their produce.

CLASS IV.

LIVE STOCK.—DISTRICT COMPETITIONS.

§ 1. CATTLE.

PREMIUMS FOR IMPROVING THE BREED OF CATTLE IN THE FOLLOWING DISTRICTS :—

1. *The Parishes of Greenock, Port-Glasgow, Kilmacolm, Largs, and Innerkip, in the counties of Renfrew and Ayr.*
2. *The Island of Mull, Argyllshire, including the Islands of Coll, Tyree, Ulva, Icolmkill, and other small isles adjacent.*
3. *The District in the west of Perthshire, comprehending the parishes of Callander, Kilmadock, Kincardine, Comrie, Balquhiddy, Aberfoyle, and Port, with that part of the District of Breadalbane comprising Glenloch, Glendochart, and Glenfalloch.*
4. *The Islands of Islay, Jura, and Colonsay, in the county of Argyll.*
5. *The District of Argyll, and the Parishes of North and South Knapdale, and the parish of Kilberry, north of the Isthmus of Tarbert, Argyllshire.*
6. *The Braemar District of Aberdeenshire, comprehending the parishes of Braemar, Crathie, Tullich, Glenmuick and Glen-gairn, but excepting that part of Tullich situated in Cromar.*
7. *The Eastern District of Fifeshire, comprehending the parishes of Kilconquhar, Elie, St Monance, Pittenweem, Carnbee, East*

Anstruther, West Anstruther, Kilrenny, Craill, Kingsbarns, St Andrew's, Denino, Cameron, Leuchars, Newburn, Largo, Leven, Scoonie, Forgan, and Ferry-Port-on-Craig.

8. *The Parishes of Inveravon, Kirkmichael, Mortlach, and Aberlour, in Banffshire, and Cabrach and Knochando, in Aberdeen and Moray shires.*
9. *The Districts of Eskdale and Liddesdale, in the counties of Dumfries and Roxburgh.*
10. *The Islands of North and South Uist, Harris, Barra, and small isles adjacent, in Inverness-shire.*
11. *The Districts of Breadalbane, Glenorchy, Glenlyon, and Rannoch, comprehending the parishes of Kenmore, Killin, Glenorchy, Fortingall, Dull, Weem, and Logierait, in the counties of Perth and Argyll.*
12. *The District of Garioch, Aberdeenshire.*
13. *The Parishes of Glenisla, Lintrathan, Kirriemuir, Lochlee, Edzel, Lethnot, Cortachy, Clova, Airlie, Glammis, Forfar, Tannadice, Fearn, Ruthven, Kingoldrum, and Menmuir, in the county of Forfar.*
14. *The District of Formartin, in Aberdeenshire.*

For the best Bull, from two to seven years old, *bona fide* the property, and in possession, of any Proprietor or Tenant in *each* of the six Districts, Nos. 1, 7, 9, 12, 13, and 14, as above described, kept on his farm, within the district, from the 20th day of May preceding the day of competition—Ten Sovereigns.

For the second best Bull, of the age above specified, *bona fide* the property, and in possession, of any Proprietor or Tenant in *each* of the said six districts, and kept on his farm, within the district, for the aforesaid period—Five Sovereigns.

For the best two Queys, of two years old, the property of, and bred by, any Tenant in *each* of the said six Districts, Nos. 1, 7, 9, 12, 13, and 14—Five Sovereigns.

For the second best two Queys, of two years old, the property of, and bred by, any Tenant in *each* of the said six Districts—Three Sovereigns.

For the best Bull, of the age above specified, exhibited at the competition in *each* of the eight districts, Nos. 2, 3, 4, 5, 6, 8, 10, and 11, *bona fide* the property of a Proprietor, Factor, or Tenant, and kept in his possession for the foresaid period—The Honorary Silver Medal.

For the best Bull, from two to seven years old, *bona fide* the property, and in possession, of any Tenant in each of the said eight Districts, Nos. 2, 3, 4, 5, 6, 8, 10, 11, kept on his farm within the District from the 20th day of May preceding the competition—Ten Sovereigns.

For the second best Bull, of the same age, in each of the said last mentioned Districts, the property, and in possession, of any Tenant, and kept on his farm within the District for the foresaid period—Five Sovereigns.

For the best two Queys, of three years old, the property of, and bred by, any Tenant in each of the said eight Districts, Nos. 2, 3, 4, 5, 6, 8, 10, 11, above described—Five Sovereigns.

For the second best two Queys, of three years old, the property of, and bred by, any Tenant in each of the said eight Districts—Three Sovereigns.

The competition in the Districts Nos. 1 to 8, both inclusive, will take place in 1836, and in Nos. 9, 10, 11, 12, 13, and 14, in 1837.

The following Members of the Society (as Members only, or their Factors in their absence, can be named) are hereby appointed Committees for regulating all details at the Competition for the Eight Districts first above mentioned. In the Districts Nos. 9, 10, 11, 12, and 13, the Committees were named in the advertisement of 1835, and the Committee for the District No. 14, will be intimated in that of 1837.

FOR THE FIRST DISTRICT.—The Earl of Glasgow; Sir Michael Shaw Stewart, Bart. M. P.; Lieutenant-General Sir Thomas M. Brisbane, K. C. B.; Lieutenant-General Darroch of Gourrock; J. C. Dunlop, Esq. Sheriff of Renfrewshire; R. Wallace, Esq. of Kelly, M. P.; R. Cunninghame Bontine, Esq. of Ardoch; James Hunter, Esq. of Hafton; Claud Marshall, Esq. Sheriff-Substitute of Greenock; William Macfie, Esq. of Langhouse; John Scott, Esq. of Hawkhill; John Scott, Esq. younger of ditto; Roger Ayton, Esq. Banker, Greenock; W. Macknight Crawford, Esq. of Cartsburn; Alexander Thomson, Esq. and J. H. Robertson, Esq. bankers, Greenock; James Watt, Esq. of Crawforddyke; James Stuart, Esq.; William Johnstone, Esq.; Robert Ewing, Esq.; Robert Sinclair, Esq.; James Mure, Esq.; Andrew Mure, Esq.; John Farrie, Esq.; James Leitch, Esq.; John Maclellan, Esq.; Maitland Young, Esq.; Charles Scott, Esq.; Adam Macleish, Esq.; John Gray, Esq. all merchants in

Greenock ; William Turner, Esq. surgeon, Greenock ; Matthew Brown, Esq. Port-Glasgow ; and any other Members in the district ; five a quorum.—Mr Wallace, of Kelly, in his absence Mr Marshall, to be Convener.

FOR THE SECOND DISTRICT.—Lieutenant-Colonel Campbell of Knock ; Lieutenant-Colonel Campbell of Possil ; John Gregorson, Esq. of Ardtornish ; Charles Gordon, Esq. of Drimnin ; Lieutenant-Colonel Robert Macdonald of Inchkenneth, C. B. ; Hugh Maclean, Esq. of Coll ; Murdoch MacLaine, Esq. of Lochbuy ; John Maclean, Esq. of Killundin ; Donald Maclean, Esq. W. S. ; Lieut.-Colonel Allan Maclean, 13th Dragoons ; Lachlan Macquarrie, Esq. of Jarvisfield ; Murdoch MacLaine, Esq. younger of Lochbuy ; Alexander Maclean, Esq. of Carsaig ; Major Lachlan MacLaine, Royals ; Colin MacLachlan, Esq. Laudle ; Eun MacLachlan, Esq. Lidisdale ; John Stewart, Esq. of Achadashinaig ; John Sinclair, Esq. of Lochaline ; and any other Members in the District ; three a quorum.—Mr Maclean of Coll, and Colonel Campbell of Possill, or either of them, to be Conveners.

FOR THE THIRD DISTRICT.—The Marquis of Breadalbane ; the Earl of Moray ; Lord Willoughby de Eresby ; Sir Evan Macgregor, Bart. ; Sir David Dundas, Bart. ; J. A. M. Macgregor, Esq. younger of Macgregor ; Alexander Buchanan, Esq. of Arnprior ; R. Cunninghame Bontine, Esq. of Ardoch ; H. Home Drummond, Esq. of Blair-Drummond ; George H. Drummond, Esq. younger of ditto ; General Graham Stirling, of Duchray and Achyle ; James Graham, Esq. of Leitchtown ; Donald Macdonald, Esq. of Craighuie ; John Burn Murdoch, Esq. of Coldoch ; William Stewart, Esq. of Ardvoirlich ; Robert Stewart, Esq. younger of ditto ; John L. Stewart, Esq. of Glenbuckie ; and any other Members in the District ; three a quorum.—General Graham Stirling, in his absence Mr Stewart, younger of Ardvoirlich, to be Convener.

FOR THE FOURTH DISTRICT.—Walter Frederick Campbell, Esq. of Islay, M. P. ; Walter Campbell, Esq. of Sunderland ; James Campbell, Esq. of Jura ; Colin Campbell, Esq. Jura ; Archibald Campbell, Esq. and Richard D. Campbell, Esq. ; Captain Alex. M'Neill, younger of Colonsay ; Duncan M'Neill, Esq. advocate ; Malcolm M'Neill, Esq. Lossit ; and any other Members in the District ; three a quorum.—Mr Campbell of Islay, in his absence Mr Campbell, of Jura, and Mr Campbell of Sunderland, to be Conveners.

FOR THE FIFTH DISTRICT.—The Duke of Argyll ; Lord John Campbell ; Sir Archibald Campbell of Succoth, Bart. ; Sir John

Poulett Orde of Kilmory, Bart. ; Robert Bruce, Esq. Sheriff of Argyllshire ; General Campbell of Lochnell ; Alexander Campbell, Esq. of Ederline ; James Campbell, Esq. of Jura ; Colin Campbell, Esq. Jura ; Duncan Campbell, Esq. of Ross ; George Campbell, Esq. Succoth ; James Archibald Campbell, Esq. of Inveraw ; John Campbell Esq. of Stonefield ; Major General Robert Campbell of Kintarbert ; Robert Campbell, Esq. of Sonachan ; Alexander Campbell, Esq. of Monzie ; Lieutenant-Colonel John Elphinstone ; Colin Macdougall, Esq. of Lunga ; Neil Malcolm, Esq. of Poltalloch ; Neill Malcolm, Esq. younger of Poltalloch ; Lachlan Macneil, Esq. of Drimdrisraig ; Dugald Sinclair, Esq. Kilchamaig ; and any other Members in the District ; three a quorum.—Sir John P. Orde, Bart., in his absence Stonefield, to be Convener.

FOR THE SIXTH DISTRICT.—The Marquis of Abercorn ; the Earl of Aboyne ; the Earl of Fife ; the Honourable Captain William Gordon, M. P. ; James Farquharson, Esq. of Invercauld ; David Gordon, Esq. of Abergeldie ; Michael Gordon, Esq. younger of Abergeldie ; John James Roy, Esq. Altdourie Cottage ; Andrew Robertson, Esq. Crathie ; and any other Members in the District ; two a quorum.—Mr Farquharson of Invercauld, in his absence, Mr Roy, to be Convener.

FOR THE SEVENTH DISTRICT.—Sir Ralph Anstruther, of Balcaskie, Bart. ; Sir John D. Erskine of Torry, Bart. ; Sir David Erskine of Cambo, Bart. ; Major Anderson of Kingask ; Major Briggs of Stathairly ; Robert Bruce Esq. of Kennet ; William Berry, Esq. of Tayfield ; George Cheape, Esq. of Wellfield ; H. Craigie, Esq. of Hallhill ; W. R. K. Douglas, Esq. of Denino ; General Durham of Largo ; J. B. Fernie, Esq. of Kilmux ; William Graham, Esq. of Greigston ; Norman Hill, Esq. of Brownhills ; Captain Kerr of Grange ; Lieutenant-Colonel Lindsay, yr. of Balcarras ; John Whyte Melville, Esq. of Mountmelville ; David Monypenny, Esq. of Pitmilley ; T. E. MacRitchie, Esq. of Craigton ; R. Gillespie Smyth, Esq. of Gibleston ; James Nairne, Esq. of Claremont ; J. Home Rigg, Esq. of Morton ; Archibald John Stewart, Esq. of St Fort ; Bethune J. Walker, Esq. of Fallfield ; John Wood, Esq. Factor, Balcarras ; James Wyld, Esq. of Gilston ; and any other Members in the District ; five a quorum.—Colonel Lindsay, and R. Bruce, Esq. of Kennet and Grangemuir ; in their absence, Major Briggs of Strathairly, to be Conveners.

FOR THE EIGHTH DISTRICT.—The Duke of Gordon ; the Earl of Fife ; the Honourable Colonel Grant of Grant, M.P. ; George Macpherson Grant, Esq. of Ballindalloch ; John Macpherson Grant,

Esq. yr. of Balindalloch ; William Grant, Esq. yr. of Elchies ; Mr Grant Ruthven ; Colonel Gordon, Inverlochy, C. B. ; Arthur Thomas Gregory, Esq. of Buchrumb ; Major Stewart, Pityvaich ; Mr Macinnes, Dandaleith, and Mr Skinner, Drumin ; three a quorum.—Ballindalloch, in his absence, Mr Skinner, to be convener.

For the 9th, 10th, 11th, 12th, and 13th Districts, the Committee remain as last year, with the addition of those resident Members since elected.

FOR THE 14TH DISTRICT.—Captain the Hon. William Gordon, M. P., in his absence, William Gordon Cuming Skene, Esq. of Pitlurg, to be Convener of the Committee of resident Members.

RULES OF COMPETITION.

1. The Conveners, with the approbation of a quorum of the Committee for conducting the several Competitions, are respectively authorised, in such cases as they shall see proper, to divide the two premiums allowed for Bulls into three premiums, in such proportions as they shall approve ; the first premium for Bulls not being less than Eight Sovereigns ; and, in like manner, to divide the sums allowed for Queys into three premiums, fixing their amount.

2. The Committee shall not place for competition any stock which, in their opinion, does not fall within the regulations prescribed, or does not possess merit ; and in no instance shall any of the money premiums be awarded, where there are not, after such selection, at least three Competitors, reserving to the Committee, in the case here provided for, to make such allowance to a party showing stock of merit, not exceeding half the amount of the premium, as, under the circumstances, they may think reasonable.

3. The times, and also the places of Competition, (except as to the tenth District, in which Benbecula is fixed as the place of competition,) are to be fixed by the Conveners, with the advice of at least a quorum of their respective Committees, and the Competitions for the Society's and for the District Premiums are to take place between the 1st of June and the 1st day of November next.

4. The Convener of each Committee will give timely notice to the other Members of the Committee of the place and time of the Competition, and will be particularly careful that the same be intimated at the several parish church doors within the District, for at least two successive Sundays previous to the Competition.

5. As these premiums were given, in some of the above-mentioned Districts, in 1831, 1832, 1833, 1834, and also in 1835, it is to be observed that the Society does not admit an animal, in any class of stock, which may have gained the Society's first premium at a District or General Show in a former year, to be again shown in competition in any District ; and for no description of stock shall either the same or a lower denomination of premium be awarded, in the District in which they have already gained a premium. In those Districts where the Honorary Silver Medal is offered for Bulls, tenants cannot compete with the same animal both for the honorary and the money premiums.

6. No Member of the Committee, showing stock of his own at the competition, shall act as judge. Nor shall factors, when they are members of the Society, and are named on the Committee, or when acting in the absence of proprietors, be entitled to compete for the money premiums, in those districts and classes in which proprietors are excluded from competition. It is recommended to the Com-

mittee to take the assistance of practical men as Judges in awarding the premiums. In all cases, the Bulls, for which the money premiums are awarded, must have served, or shall be kept to serve, the District, for at least one season, at a moderate charge for each cow, and the rate may be fixed by the Committee. The same person is not to obtain more than one of the premiums for Bulls, nor more than one of the premiums for Queys, in one year, except in those Districts where tenants compete for the honorary and money premiums for Bulls, in which case they may, with different animals, carry the medal and one of the money premiums. While the Directors have deemed it expedient to exclude Proprietors and Factors named on the Committee, or acting in the absence of Proprietors, from competing for the *money premiums* in certain Districts where it is apprehended that the superiority of their stock might discourage competition on the part of the tenantry, they are fully impressed with the advantages of having such stock exhibited at the District Shows, and have offered the Honorary Silver Medal of the Society for the best Bull exhibited at the competition, should he be the property of one in that class, and superior to the Bull to which the highest money premium is awarded.

7. In order to entitle the Competitors to their respective premiums, a regular report, signed by the Convener, and at least a majority of the Committee who attend the competition, must be transmitted by the Conveners, so as to be received by the Secretary on or before the 10th of December next, and which report must specify the ages of the Bulls and Queys preferred; the length of time the Bulls have been in the possession of the competitors, and, with respect to the queys, that they were bred by the competitors, and were their property on the day of competition; the number of bulls and queys respectively produced thereat; the number placed for competition in each class; the names and designations of the persons to whom the premiums have been adjudged; amount of premiums voted to each; and, in general, that all the rules of competition fixed by the Society, as above mentioned, have been strictly observed; and, in particular, that the previous intimations to the Committee of Judges, and advertisements at the church doors, were regularly made as required. In case all the Members of the Committee who may have attended shall not have subscribed the report, the Convener will mention the cause which may have prevented their doing so.

Further, it is to be distinctly understood, that in no instance does any claim lie against the Society for expenses attending a show of stock, beyond the amount of the premiums offered.

With reference to the competitions in the 1st district, the report must bear, that the Bulls and Queys preferred were of the Ayrshire Dairy Breed; in the 2d, 3d, 4th, 5th, 8th, and 10th, that the Bulls and Queys were of the West Highland Breed; in the 7th of the Fifeshire Breed; and in the 12th and 14th, of the Aberdeenshire Breed, the 12th being limited to the Polled Aberdeenshire. A certain portion of the premiums in the 3d district is authorised to be assigned to Stock of the Dairy Breed.

Conveners are requested to get the reports drawn up and signed by a majority of the Committee present at the competition, before they separate.

NOTE.—The Society impressed with the benefit to be derived from continuing these competitions in the same districts for a longer period than was formerly the practice, gives the premiums for three competitions in alternate years; and provided the gentlemen of the district, or any local association therein, shall have continued the competitions, and have awarded premiums in the district to an amount not less than one-half the Society's premiums, and for the same description of stock, during the two intermediate years, the Society

continues its premiums to the district for an additional year. By this arrangement each district may have the benefit of six competitions. In districts Nos. 1, 2, and 3, 1831 was the first year's competition; local premiums were awarded in the two years when the Society's were vacant, and these districts have now the sixth or additional year's competition. In districts Nos. 4, 5, and 6, 1834 was the first year's competition; local premiums were awarded in 1835; and this year they have the Society's premiums, which will be again given in these districts in 1838 and also in 1839, provided the districts award local premiums, as before mentioned, in the year 1837. In the districts Nos. 7 and 8, this is the first year's competition for the Society's premiums; if they award local premiums in 1837 and 1839, they will be entitled to the Society's premiums in 1838 and 1840, and also in 1841. The district, No. 14, is now offered for 1837, as the first year's competition, and the Premiums will be continued in 1839 and 1841; and if the district gives premiums in 1838 and 1840, they will also be continued in 1842. Farther, in order to encourage the show for the local premiums, the Society, in those districts in which the Honorary Silver Medal is given, will continue it in the two intermediate years, under the same conditions as during the years when the Society's premiums are given. A certificate of the competition and premiums awarded at the intermediate local shows in the several districts, signed by at least two Members of the Society, must be transmitted to the Secretary of the Society, so as to be received by him on or before the 10th December in each year, in order to entitle the districts to any claim for the additional year's premiums.

§ II. WORK HORSES.

PREMIUMS FOR IMPROVING THE BREED OF DRAUGHT HORSES.

1. *The County of Argyll.*
2. *The County of Sutherland.*
3. *The Counties of Ross and Cromarty.*
4. *West Tiviotdale,—Roxburghshire.*

In each of the above districts Twenty-five Sovereigns will be given by the Society, a Sum not less than Twenty Sovereigns additional being given by the resident gentlemen, or by local Societies, for the improvement of the breed of Draught Horses. The premiums to be as follows:—

For the best Stallion, not under three years and nine months, and not exceeding twelve years old, kept exclusively for the improvement of the breed of Draught Horses, within each of the two districts Nos. 1 and 2, and for this purpose to be shown after the premiums have been awarded at such stations as may be fixed by the Conveners and Committee of members of the Society resident in the respective counties, for service by each of the Prize Stallions of not more than seventy Mares, at a rate not exceeding one Sovereign for each, at such times between the 1st April and the 1st August 1836, as the respective Committees may fix, at a meet-

ing to be called by the Conveners for the purpose—Twenty-five Sovereigns.

For the best Mare for breeding Draught Horses, not exceeding twelve years old, and which shall have had at least one foal, *bona fide* the property and in possession of any tenant in each of the said two districts, from 1st January 1836, to the day of competition—Ten Sovereigns.

For the best Entire Colt, not exceeding forty-five months old, *bona fide* the property of any proprietor or tenant in each of the said two districts—Ten Sovereigns.

NOTE.—The premium to the best Stallion must be awarded under the condition, that the Prize Mare, and the Mare which shall be declared by the judges next in merit, shall have a preference of service by the Prize Stallion, free of charge; all the competing Mares to have a preference over other Mares to service by the Prize Stallion, on such terms and conditions as the local Committees shall fix, but the charge in no case to exceed the sum indicated by the terms of the Premiums. Evidence must be produced that the Prize Stallions have had produce.

RULES OF COMPETITION.

The time and place of competition for the Premiums are to be fixed by the Conveners, with the concurrence of at least a quorum of the respective Committees, and are to be published by the Convener, at the church doors, in due time, or in such other manner as shall be thought by him and a quorum of the Committee effectual for the information of those interested.

The competition will take place, in the First and Second Districts, betwixt 20th March and 1st May 1836, and in the Third and Fourth Districts within the same period in 1837. The regulations for cattle shows, in regard to fixing the competitions,—the previous intimation to the Committee and competitors,—the recommendation to the Committee to take the assistance of practical men as judges,—the power of the Committee to withhold the Premiums, if the animals produced shall be of inferior character,—those relating to extra expenses, and against competitors being also judges,—and the manner in which the Reports are to be certified and transmitted to the Society, are severally hereby declared applicable to the premiums for horses.

The premiums now intimated for the First District are for the second year's competition, and the first competition in the Districts Nos. 2, 3, and 4. The expediency of continuing the premiums for another year in the second, third, and fourth Districts, is open for consideration, provided the Districts shall respectively propose again to guarantee a sum equal to what they now contribute.

The Members of the Society in the respective districts are appointed Committees for regulating every thing relative to the competitions, with power to name Sub-Committees of their number for attending to the necessary details.

FOR THE FIRST DISTRICT.—Sir John Poulett Orde of Kilmory, Bart. and Robert Maclachlan, Esq. of Maclachlan, or either of them, to be Convener of the Committee of resident Members; five a quo

FOR THE SECOND DISTRICT—The Duke of Sutherland, in his Grace's absence George Gunn, Esq. factor on the estate of Sutherland, to be Convener of the Committee of resident Members; three a quorum.

FOR THE THIRD DISTRICT.—Colin Mackenzie, Esq. of Kilcoy, Convener of the County of Ross, and Roderick Macleod, Esq. of Cadboll, M. P., or either of them, to be Conveners of the resident Members; five a quorum.

FOR THE FOURTH DISTRICT.—His Grace the Duke of Buccleuch, in his absence Allan Elliot Lockhart, Esq. of Cleghorn, to be Convener of the resident Members; three a quorum.

§ III. SHEEP AND WOOL.

PREMIUMS FOR IMPROVING THE BREED OF SHEEP IN THE FOLLOWING DISTRICTS.

1. *The following District in Inverness-shire, viz. from the Ferry of Balachulish on the west, to the march of Letterfinlay, with Glengarry on the east, including both sides of Loch Lochy, both sides of Loch Arkeg, Lochail until it reaches Glenfinnan, the whole of Glenspean and Glenroy, so far as the Badenoch march on both sides, and also including the District of Ardgour, in Argyllshire.*
2. *The Districts of Badenoch and Rothiemurchus in Inverness-shire.*
3. *The Districts of Morven and Ardnamurchan, Argyllshire.*

For the best six Tups of the black-faced breed, not exceeding four years old, the property of any proprietor or tenant in each of the said two first districts, which shall be certified at the Competition to belong to a flock of not less than 120 Ewes, and to have been no otherwise grazed or fed during the last season than the exhibitor's Tups of the same age, and to have served the Ewes of the flock in the same manner, and at least for one month of the season—Six Sovereigns.

For the second best Six ditto—Four Sovereigns.

For the best Pen of eighteen Gimmers or Ewes of the black-faced breed, from sixteen to twenty months old, the property of any proprietor or tenant within each of the said two first Districts, and which shall be certified at the Competition to have been at least one year in his possession, and to have been, during that year, grazed on the same kind of pasture with the remainder of the flock of the like age—Six Sovereigns.

For the second best Pen as aforesaid—Four Sovereigns.

Premiums for Sheep of the Black-faced breed will be given in the third District in 1837, as the first Competition for the Society's Premiums. The first Competition to be held at Keil, and the second at Strontian.

The following Members of the Society are appointed Committees for awarding the Premiums for Sheep :—

FOR THE FIRST DISTRICT.—The Earl of Aboyne, Lord Strathaven ; Sir Duncan Cameron of Fassifern, Bart ; Donald Cameron, Esq. of Lochail ; John Cameron, Esq. Corrychoiley ; Robert Flyter, Esq. Sheriff-substitute, Fort William ; James Greig, Esq. Tullich ; Major-General Macdonell, Coldstream Guards ; Colonel Maclean of Ardgowder ; Captain John Macdonell, Killiehonet ; Thomas Macdonald, Esq. Fort William ; James Macgregor, Esq. Fort William ; John Walker, Esq. of Crawfordton, and any other Members resident in the District ; three a quorum.—Sir Duncan Cameron and Colonel Maclean of Ardgowder, or either of them, to be Convener.

FOR THE SECOND DISTRICT.—The Duke of Gordon ; the Duke of Bedford ; Sir Joseph Radcliffe, Bart. ; Ewen Macpherson, Esq. of Cluny ; George Macpherson Grant, Esq. of Ballindalloch and Invereshie ; John Macpherson Grant, Esq. younger of do. ; Colonel Duncan Macpherson ; Captain Macpherson of Glentruim ; Allan Macpherson, Esq. Kingusie ; William Mitchell, Esq. of Gordonhall, and any other Members in the District ; three a quorum.—Cluny Macpherson ; in his absence, Captain Macpherson, Glentruim, to be Convener.

FOR THE THIRD DISTRICT.—Sir James Miles Riddell, Bart. ; in his absence, John Gregorson, Esq. of Ardtornish, to be Convener of the Committee of resident Members.

§ IV. SWINE.

PREMIUMS FOR IMPROVING THE BREED OF SWINE.

1. *The Counties of Moray and Nairn.*
2. *The County of Inverness.*
3. *Kintyre, Argyllshire.*

For the best Boar, not under twelve months, and not exceeding four years old, *bona fide* the property and in possession of any proprietor or tenant in the first and second Districts, in autumn 1836—Seven Sovereigns.

For the second best—Three Sovereigns.

For the best Breeding Sow of the same age—Four Sovereigns.

For the second best—Two Sovereigns.

These premiums to be awarded for animals that are con-

sidered most profitable, and best suited for the purpose of curing mess pork. Attention is recommended to the introduction of the Berkshire or Suffolk breed of Swine, as being the best for curing pork.

The Competitions are to be held at such times as the Society's Members resident in the districts shall fix, at a meeting to be intimated by the respective Conveners for the purpose. This meeting is also authorized to name a Committee for managing all details, and to fix the necessary regulations for competition.

A Report of the award of the Premiums, with a copy of the Regulations of Competition, to be transmitted to the Secretary on or before the 10th of December 1836, for the First and Second Districts, and by the same date in 1837, for the Third District. Elgin is fixed as the place of Competition for the First, Inverness for the Second, and Campbelltown for the Third District.

FOR THE FIRST DISTRICT.—Major Cumming Bruce, of Roseisle and Kinnaird, M. P.; in his absence, Peter Brown, Esq. Linkwood, to be Convener.

FOR THE SECOND DISTRICT.—John Stewart, Esq. of Belladrum; in his absence, J. Mackenzie, Esq. banker, Inverness, to be Convener.

FOR THE THIRD DISTRICT.—Richard Campbell, Esq. of Auchnabreck; in his absence, J. L. Stewart, Esq. of Glenbuckie, to be Convener.

The premiums were given in the First District in 1834. Their continuance in 1836 was made dependent on the award of the same description of premiums in the year 1835, by the Gentlemen of the district, or any local association therein.

The continuance of the premiums in 1837 in the Third District, and in 1838 in the Second District, will be dependent on a similar condition as to the award of the local premiums in the intermediate years.—A Report of the award of the local premiums, signed by at least two Members of the Society, to be transmitted to the Secretary of the Society from the First and Second Districts on or before the 10th December 1836.

CLASS V.

PRODUCTS OF LIVE STOCK.

§ 1. CURING BUTTER.

DISTRICTS.

1. *The District of Perthshire, comprehending the Parishes of Dunblane, Kilmadock, Port of Monteith, Aberfoyle, and Kin-cardine.*
2. *The County of Caithness.*
3. *The County of Orkney and Zetland.*

The premiums given, and regulations suggested, for promoting an improved system of Curing Butter, having been productive of highly satisfactory results, the following premiums are offered in the first district in 1836.

To the owner of any Dairy in the said first district who shall make and cure the best quality of Butter for the market, not being less than two cwt. (112 lb. to the cwt. or 16 oz. to the lb.) during the season 1836—Six Sovereigns.

For the second best quality, as aforesaid—Four Sovereigns.

For the third best quality, as aforesaid—Three Sovereigns.

For the fourth best quality, as aforesaid—Two Sovereigns.

Similar Premiums to be given in the second and third districts in 1837.

CONDITIONS.

The Butter in the First District must be certified on oath to have been made and cured on the competitor's farm, during the season 1836; and the affidavit must bear that the sample of one or more kits or firkins produced is a fair average of the quantity made and cured as aforesaid. It shall be inspected by a Committee of the Members of the Society resident within the respective districts, at a meeting to be called by the Convener for that purpose, on such days as the Convener may appoint. The quality of the Butter to be tested by judges to be named by the Committee, in the way usually done by purchasers in the public market. In the event of two or more competing lots being deemed equal in quality, the premium will be awarded to the larger quantity. Although not required as a condition, it is strongly recommended, as affording facilities for sales, that the Butter should be packed in firkins containing 56 lb. each, or in earthen vessels which have not been glazed with preparations of lead, and of such size as may be suitable for sales.—The successful candidates, before receiving the premiums, are required to transmit to the Secretary a detailed report of the whole process followed by them in the manufacture of their Butter. Reports of the award of the premiums in the First District to be lodged with the Secretary of the Society, on or before the 10th December 1836.

H. Home Drummond, Esq. of Blairdrummond; in his absence J. Burn Murdoch, Esq. of Coldoch, to be Convener in the first district; James Traill, Esq. of Ratter; in his absence William Horne, Esq. of Scouthell, and James Sinclair, Esq. of Forss, or either of them, to be Conveners in the second district; and Robert Bruce, Esq. of Sumburgh, to be Convener in the third district.

§ II. MAKING CHEESE.

1. SWEET OR FULL MILK CHEESE.

DISTRICT.

The County of Stirling, including the Parishes of Cumbernauld and Kirkintulloch, in Dumbartonshire.

The sum of Fifteen Sovereigns will be placed at the disposal of

the members of the Society in the above district, Five Sovereigns more being provided by the gentlemen of the district, or by any local association therein, to be divided and apportioned in such manner as to the respective Committees shall seem best for the improvement of Cheese-making in the said district, in 1837, under the regulations after mentioned.

CONDITIONS.

The Cheese to be made of any variety which the competitor may consider best and most suitable for the market, and the quantity made by the competitor of each variety intended for competition, shall not be less than one cwt. (112 lb., of 16 oz.). Each competitor shall lodge with one or other of the Conveners of the Committee a memorandum specifying the kinds of Cheese for which he is to compete, and a certificate on oath must be lodged with one of the Conveners that two or more cheeses to be produced are a fair average sample of the kind competing, made in that year, by the competitor, and one of the cheeses of the successful specimens shall be transmitted to the Secretary for the inspection of the Society.

It is expected that intending competitors shall communicate their intention to the Conveners, that they may have it in their power to inspect the Dairies if they think proper; and the successful competitors before receiving payment of their premiums, are required to transmit to the Secretary a detailed report of the whole process employed by them in the manufacture of their cheese, and specifying the quantities of cheese made by them of the description offered for competition, the object being not to produce a few superior cheeses, but to improve the system, which, in some districts of Scotland, where premiums have been given, has been found to have attained great perfection,—as well as to ascertain the general quantity of superior cheese to be procured from the district competing. The cheeses to be examined, and the premiums awarded, by the local Committee, at such places as the Society's Members shall appoint, at a meeting in each district, to be intimated by the Conveners for that purpose; and which meetings shall also name a Committee for fixing such farther regulations as may be necessary, and arranging all details. In fixing farther regulations, it is suggested to the Committee to obtain from the competitors, where practicable, information as to the expense of the manufacture, and the price obtained for the cheese in the market. Reports of the awards of the premiums to be transmitted to the Secretary of the Society on or before the 10th December 1837.

H. Home Drummond, Esq. of Blairdrummond, and William Murray, Esq. of Polmaise, or either of them; in their absence J. Burn Murdoch, Esq. of Coldoch, to be Conveners.

2. SKIM-MILK CHEESE.

DISTRICT.—*County of Banff.*

The Society being of opinion that in districts where butter is the staple produce of the dairy, Cheese made from Skimmed Milk may be so improved in quality as to be brought into successful competition with Dutch cheese, a large quantity of which, from

the same material, is annually imported into this country, offers the following premiums in Banffshire :—

To the owner of any Dairy, in the said County, who shall make for sale the best quality of Cheese, from skimmed milk, not being less than one cwt. (112 lb. 16 oz.) during the season 1836—Eight Sovereigns.

For the second best quality as aforesaid—Five Sovereigns.

For the third best quality as aforesaid—Two Sovereigns.

The competition will take place at Keith on such day as shall be fixed by the Local Committee, and under the same regulations as the competition held there in 1834, copies of which may be had on application to the Conveners.

It is expected that intending competitors shall communicate their intention to the Conveners, that they may have it in their power to inspect the Dairies if they think proper; and the successful candidates, before receiving their premiums, are required to transmit to the Secretary a detailed account of the whole process followed by them in the manufacture of their cheese.

At a Meeting to be called by the Conveners, a Committee will be named for fixing such farther regulations as may be deemed necessary, for managing all details. The respective Committees will then define the time for milking, when the milk, from which the competing cheese is to be made, shall have been skimmed; and it is suggested that they should, where practicable, require information as to the expense of the manufacture, and the price obtained for the cheese in the market. Colonel Gordon of Park, and Patrick Steuart, Esq. of Auchlunkart, or either of them, to be Conveners of the Society's Members resident in the County, who are appointed a Committee for regulating all details.

A report of the award of the premiums to be transmitted to the Secretary of the Society, on or before the 10th December 1836.

CLASS VI.

COTTAGES.

1. PREMIUMS IN MONEY TO COTTAGERS FOR THE CLEANEST KEPT COTTAGES.

DISTRICTS.

1. *The County of Perth.*

2. *The County of Dumbarton.*

In order to excite the attention of Cottagers to keeping their cottages neat and clean,—ten Premiums of Two Sovereigns each,

will be awarded to Ten Cottagers in each of the above Districts, paying L.5 of yearly rent or under—or whose cottage and land annexed to it does not exceed that annual value—who shall be certified by two members of the Society, resident in the district, or by one member of the Society and the clergyman of the parish, to have been distinguished for the general neatness and cleanliness of the interior, as well as the exterior, of his or her cottage (including the garden, should there be one attached to it), and to be deserving, on that account, of this mark of the Society's approbation.

CONDITIONS.

The certificate must bear that the cottage has been personally inspected by the parties granting it, and must give some description of the merits of the cottager, in respect of the manner in which the cottage, as well as the immediately adjoining space, have been kept, specifying, at the same time, the name, designation, and residence of the competitor. The certificates must be forwarded by the 1st of November next, to the gentleman appointed to act as Convener in the division of the county in which the competitor resides, in order to the various certificates from such division being examined, and afterwards transmitted by the Convener, so as to reach the Secretary of the Society on or before the 20th November 1836.

Should there be more than ten competitors in each county, the Society will be influenced by the circumstances of the case in deciding what claims are to be preferred; but, in every case, their decision will have regard exclusively to the neatness and cleanliness with which the cottage and immediately adjoining space have been kept, and not the construction of the cottage, or to the materials of which it is composed.

CONVENERS FOR PERTHSHIRE.—Perth Subdivision—Mr Smyth of Methven and Mr Grant of Kilgraston. Dunkeld—Sir J. Muir Mackenzie and Mr Butter of Fascally. Blairgowrie—Mr Clerk Rattray of Craighall, and Mr Small Keir of Kinmonth. Weem—Sir Neill Menzies and Mr Robertson of Edradynate. Culross—Mr Clark of Comrie. Auchterarder—Captain Hunter of Auchterarder, and Mr Hepburn of Culquhailzie. Crieff—The Hon. Sir P. Murray, Bart. and Sir D. Dundas, Bart. Dumblane—Mr Home Drummond of Blairdrummond, and Mr Burn Murdoch of Coldoch. Carse of Gowrie—Mr Thriepland younger of Fingask, and Mr Richardson of Pitfour. Cupar—Mr Wright of Lawton, and Mr Hay of Ballindoch.

CONVENERS FOR DUMBARTONSHIRE.—Cumbernauld and Kirkintullock—Admiral the Hon. C. E. Fleming of Biggar and Cumbernauld. East and West Kilpatrick—Mr Hamilton of Barus, and Mr Buchanan of Auchintoshan. Middle District, comprehending Dumbarton, Bonhill, Kilmaronock, and Cardross—Mr Smollett younger of Bonhill, and Mr Stott of Balloch Castle. Western District, comprehending Luss, Arroquhar, Row, and Roseneath—Sir James Colquhoun of Luss, Bart. and Mr Campbell, Roseneath.

With the view of putting the Premiums to Cottagers into more effective operation, by continuing them for several competitions in each district, the Society will give L. 5 annually, for four years, to the first district, consisting of four parishes, in each of the counties after mentioned, which shall, within the limited time after specified, deliver to the Secretary a satisfactory guarantee for an equal sum being placed by such parishes at the disposal of the Society for the same purpose. The Society will further give its Cottage Medal for the best kept Cottage within the bounds of the district. The Society will likewise give a premium of Two Sovereigns for the Cottage Garden most tastefully laid out, most productive, and neatly kept. The premium for Gardens is offered to the same class of persons, and on the same conditions, as the premiums for Cottages.

COUNTIES.	Time within which the guarantee must be lodged.	First year in which these premiums will be distributed.
Kinross and Clackmannan,	1st January 1837.	1837.
Stirling,	1st January 1837.	1837.
Lanark,	1st January 1838.	1838.
Fife,	1st January 1838.	1838.
Mid-Lothian,	1st January 1839.	1839.
Selkirk,	1st January 1839.	1839.
East-Lothian,	1st January 1840.	1840.
Orkney and Zetland, . . .	1st January 1840.	1840.

2. MEDALS TO COTTAGERS.

In the view of giving still farther encouragement to Cottagers of the above description, who do not reside in the counties in which the regular premiums are in operation, and, at the same time, of giving aid to local associations and public spirited individuals, establishing or continuing, at their own expense, premiums for the like object, the Society will give its Cottage Medal to such associations or public spirited individuals as apply for the same, and may be desirous to add that testimony of approbation to such premiums as they themselves bestow.

Applications for these Medals, stating the nature and amount of the encouragement which is to be afforded by the parties applying, to be made to the Society on or before the 1st of July in each year, so that the Association or individual making the application may be enabled to intimate that the Medals are to be given. The Medals will afterwards be issued upon a Report, certified in the terms required by the preceding conditions, describing the merits of the Cottagers. The Reports to be lodged with the Secretary before the 10th November of the year in which the application is made.

3. PREMIUMS TO COTTAGERS FOR PROMOTING ATTENTION TO THE CULTIVATION AND MANAGEMENT OF BEES.

DISTRICTS.

1. *The Counties of Edinburgh and Haddington.*
2. *The County of Orkney and Shetland.*

To the Cottager in the first district paying L. 5 of rent or under, or whose cottage and land annexed to it does not exceed that annual value, who, between the 1st June and 1st October 1836, shall have raised the greatest number of Hives of Bees, not fewer than Seven, from stocks of his or her own property, none of the hives weighing under 20 lb. exclusive of the weight of the material of the hive or skep—A premium of Four Sovereigns.

To the Cottager in the same district who shall have raised the second greatest number, as aforesaid—Three Sovereigns.

To the Cottager in the same district who shall have raised the third greatest number—Two Sovereigns.

To the Cottager in the same district who shall have raised the fourth greatest number—One Sovereign.

Certificates of the number of Hives, and their several weights, making allowance for the weight of the skeps, (which are weighed before being used), signed by two Members of the Society resident in the neighbourhood, or by one Member and the clergyman of the parish, to be transmitted to the Secretary on or before the 10th November 1836.

Similar premiums will be given in the second district for Hives raised between the 1st June and 1st October 1837.

CONVENERS FOR THE COUNTY OF EDINBURGH—Edinburgh District—Mr Wauchope of Edmonstone. Dalkeith—Sir John Hope, Bart. and Mr Scott Moncrieff. Gala Water—Mr Borthwick of Crookstone. Corstorphine—The Earl of Rosebery and Sir Alexander Maitland Gibson, Bart. Calder—The Earl of Morton and Mr Young of Harburn.

CONVENERS FOR THE COUNTY OF HADDINGTON—Haddington—Colonel Houston of Clerkington. Gifford, &c.—The Marquis of Tweeddale and Mr Hay of Hopes. Dirleton, &c.—Mr Ferguson of Raith, M.P. Prestonkirk, &c.—Mr Balfour of Whittinghame. Pencaitland, &c.—Colonel Maclean of Ardgower Tranent, &c.—Mr Aitchison, younger of Drummorie. Dunbar, &c.—Mr Hunter of Thurston.

In order that the Premiums offered may be made known to the industrious Cottagers, the Society trusts much to the obliging co-operation of the Clergy in the Counties in which the Cottage Premiums are in operation.

CLASS VII.

WOODS AND PLANTATIONS.

1. HONORARY PREMIUM FOR EXTENSIVE PLANTING.

To the Proprietor who shall, within a period of five years immediately preceding, have planted on his property the greatest extent of ground, not being less than 500 acres, and who shall communicate to the Society, on or before the 10th of November in any year, a satisfactory report of his operations, embracing the expense, description of soil, age, and kind of Trees planted, the number of each sort per acre, mode of planting, extent of "beetting up," and general progress of the plantation, with such observations as his experience may suggest—The Gold Medal.

2. REPORTS ON RECENT PLANTATIONS.

To the Proprietor who shall communicate to the Society, on or before the 10th of November in any year, the most satisfactory Report on the Planting of Land, founded on experiment; and who shall, accordingly, have planted on his own property an extent of not less than Fifty acres, within a period of seven years preceding the date of his Report—The Gold Medal.

The Report should comprehend every interesting particular; among others, the exposure and altitude of the place, and general character of the soil—the mode of fencing and of planting adopted—the kind of trees planted, and the number of each kind per acre—their relative progress—the proportion of blanks or deaths at the end of three years—the state of the plantation at the date of making the Report, and the expense per acre, as nearly as can be calculated.

3. NATIVE FIR WOODS.

For the best and approved account of any of the Districts of Scotland where the *Pinus sylvestris* is indigenous, and abounds so as to constitute a native forest—The Honorary Silver Medal.

It will be expected that a view should be given both of the past and present state of the woods in such district, and of the nature of the situations, and of the *soil* and *subsoil* where the trees appear to thrive best. It will be desirable also that measurements of some of the largest trees should be given, and a state-

ment of their age as far as it can be ascertained by counting the rings or annual layers on felled trees of similar dimensions. The comparative growth of any other native trees which occur in the District, such as Birch and Oak, should be mentioned, and the undergrowth and general state of the pasture-herbage should be described. Any circumstances which may appear to the writer likely to throw light on the growth and management of native fir woods should be adverted to.

4. FIR PLANTATIONS.

For the best and approved account of the Fir Woods in any District of Scotland to which the *Pinus sylvestris* is not indigenous, including the various particulars above mentioned—The Honorary Silver Medal.

5. COLLECTING THE SEEDS OF THE *PINUS SYLVESTRIS* FROM NATIVE TREES.

To the person in Scotland who shall, between the 30th of October 1833, and the 30th of October 1836, have collected and sown, or sold for sowing, the greatest quantity of Seeds of the *Pinus sylvestris*, from healthy and free growing trees of natural growth in the Highland Districts of the counties of Aberdeen, Moray, or Inverness, or who shall have imported from Norway, Sweden, Germany, or Switzerland, and sown, or sold for sowing, the largest quantity of the same kind of native seed, taken from full grown healthy trees in these countries, and in no case from the immediate vicinity of the sea—the quantity not to be less than 1000 lb. of clean seeds—A Premium of Twenty Sovereigns, or a Piece of Plate of that value.

Competitors to transmit to the Secretary of the Society, on or before the 10th of November 1836, affidavits in support of the collection of the seed from proper trees, and specifying the quantity, the district where collected, or the place from which it was imported, and of its having been sown or sold, and, in the latter case, the name of the purchaser to be specified. The cost price, and, if sold, the price obtained, to be also stated.

6. INTRODUCTION OF NEW FOREST TREES INTO SCOTTISH PLANTATIONS.

To the person who shall, on or before the 20th of October in any year, report to the Society the introduction into forest or ornamental Plantations of any new species of Forest Timber or or-

namental Tree, suited to the climate of Scotland—The Honorary Silver Medal, or a Piece of Plate of such value as the communication may be adjudged to deserve.

Satisfactory evidence will be required, that the tree introduced is new to the plantations of Scotland, and congenial to its soil and climate. A particular account of the tree, including the manner in which it is raised, and its after management, or the condition in which it grows spontaneously, together with the circumstances which led to its introduction, must be furnished. The number planted to be specified, and a specimen of the wood must accompany the report, if the reporter be able to furnish it, or, at all events, a specimen of a branchlet of the tree.

7. INTRODUCTION OF FOREST TREES NOT YET KNOWN IN A LIVING STATE IN SCOTLAND.

To the person who shall, in any year, most successfully transmit to the Society, in a state fit for germination, Seeds of Forest Trees, not yet in cultivation in this country, and which are natives of such places as, from their latitude or altitude, may be expected to produce trees hardy in the climate of Scotland—The Gold or Silver Medal, or a piece of Plate of such value as the Directors in the circumstances of the case may think suitable.

The Society would particularly wish to direct (but by no means to confine) attention to the Fir tribes; and the countries from which contributions are particularly expected are the north-west part of America, the table-land of Mexico, such parts of the Andes as have sufficient elevation, and the Himalaya Mountains, or the great plains to the northward of them. The seeds may be sent home in the cones, wrapped in brown paper, packed in a box, and kept in a cool airy part of the cabin, but by no means in the hold, nor in tin cases. If competitors possess the means, by themselves or their correspondents, of trying their vegetation in this country, it will be desirable that they should do so; but, otherwise, if the seeds be sent to the Secretary of the Society, they will be tried under the direction of the Society, so as to afford every chance of success. The transmission of living plants in boxes, or in cases covered with glass panes, may be attempted, where practicable: the external air should be excluded, and almost no water given during the voyage. Where this plan is adopted, smaller seeds, berries, or hews, may be thickly mixed with the soil or earth in which the plants are placed.

8. MORE EXTENDED INTRODUCTION OF KNOWN SPECIES OF THE FIR TRIBE.

To the person who shall, within three years from 1835, inclusive, have introduced from any part of the world, cones containing seeds capable of germination, the produce of hardy species of the Fir Tribes which have been already introduced into Britain, but of which only a few plants have been raised—The Gold or Silver Medal, or a piece of Plate of such value as the Directors may, in the circumstances of the case, deem adequate.

It is required that the quantity of cones of each species imported shall be sufficient to afford at least 500 seedling plants, and farther, that, before the premium be awarded, the number of seedling plants of each species actually raised in Scotland shall not be less than 100. Attention is particularly directed to *Araucaria imbricata*, *Pinus ponderosa*, *Lambertiana*, and *Sabiniana*; to *Abies Douglasii*, *nobilis*, *grandis*, and *Menziesii*; and to *Taxodium sempervirens*, which last is abundant in the vicinity of St Francisco, and throughout the low sandy plains of California.

CLASS VIII.**IMPLEMENTS OF HUSBANDRY AND USEFUL MACHINES.**

To the person who shall invent or improve any Instrument or Machine applicable to Husbandry or Rural Economy, and which, from its utility in saving labour or expense, simplicity, or cheapness of construction, or other circumstances, shall be deemed by the Society deserving of public notice—The Silver Medal, or such sum in money as the communication shall appear to deserve.

The account of the implement must be accompanied by a model made, when convenient, to a scale of three inches to the foot, to be deposited in the Society's Museum. The model to be formed of wood or metal; and the notice or description transmitted with it must specify, according to the best of the inventor's abilities, the purpose or advantage of his invention or improvement.

CLASS IX.

GENERAL SHOW OF LIVE STOCK

AND

AGRICULTURAL MEETING AT PERTH IN 1836.

THE Society having resolved to hold the General Show of Live Stock and Agricultural Meeting for 1836, at Perth, the following Premiums are offered to be then awarded by the Society, aided by liberal donations from the Noblemen and Gentlemen of the Counties, from the City of Perth, and from the Local Associations more immediately connected with the Show.

§ I. CATTLE.

SHORT-HORNED BREED.

CLASS I. For the best Bull, calved after 1st January 1829—Fifteen Sovereigns.

For the second best ditto—Seven Sovereigns.

It is a condition attached to these Premiums that the exhibitors shall be obliged to let out the prize Bulls within the four counties of Perth, Forfar, Fife, and Kinross, and to allow each of the Bulls to serve at least forty cows during the season 1837, on payment of ten shillings and sixpence for each cow. The owner, if resident within the district, to have a preference of service for his own stock.

To the *Breeder* of the best Bull in this class—the Honorary Silver Medal.

II. For the best Cow of any age—Ten Sovereigns.

III. For the best two Heifers, calved after 1st January 1834—Seven Sovereigns.

IV. For the best two Steers, calved after 1st January 1834—Ten Sovereigns.

V. For the best two fat Oxen, calved after 1st January 1833—Ten Sovereigns.

WEST HIGHLAND BREED.

VI. For the best Bull, calved after 1st January 1829—Fifteen Sovereigns.

For the second best ditto—Seven Sovereigns.

To the *Breeder* of the best Bull in this class—The Honorary Silver Medal.

VII. For the best Cow of any age—Ten Sovereigns.

VIII. For the best two fat Oxen, calved after 1st January 1832, fed exclusively on farm produce—Ten Sovereigns.

IX. For the best two fat Oxen, calved after 1st January 1833—Seven Sovereigns.

X. For the best two Heifers, calved after 1st January 1833—Seven Sovereigns.

XI. For the best two ditto, calved after 1st January 1834—Five Sovereigns.

XII. For the best five Oxen, calved after 1st January 1834, bred by the exhibitor—Ten Sovereigns.

AYRSHIRE BREED.

XIII. For the best Bull, calved after 1st January 1830—Fifteen Sovereigns.

To the *Breeder* of the best Bull in this class—The Honorary Silver Medal.

XIV. For the best Cow of any age—Ten Sovereigns.

XV. For the best two Heifers, calved after 1st January 1834—Five Sovereigns.

GALLOWAY, POLLED ANGUS, AND POLLED ABERDEENSHIRE BREEDS.

XVI. For the best Bull, calved after 1st January 1830—Fifteen Sovereigns.

For the second best ditto—Seven Sovereigns.

To the *Breeder* of the best Bull in this class—The Honorary Silver Medal.

XVII. For the best Cow of any age—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

XVIII. For the best two Heifers, calved after 1st January 1834—Seven Sovereigns.

XIX. For the best two fat Oxen, calved after 1st January 1833—Ten Sovereigns.

XX. For the best two fat Oxen, calved after 1st January 1832—Ten Sovereigns.

FIFE BREED.

XXI. For the best Bull, calved after 1st January 1830—Fifteen Sovereigns.

To the *Breeder* of the best Bull in this class—The Honorary Silver Medal.

It is a condition attached to the premiums for Bulls in Classes 6, 13, 16, and 21, that the exhibitors shall be obliged to keep the

Premium Bulls within the four counties, and allow each of them to serve at least forty Cows during the season 1837, on payment of five shillings for each Cow. The owner, if resident within the district, to have a preference of service for his own stock.

XXII. For the best Cow, of any age—Ten Sovereigns.

XXIII. For the best two Fat Oxen, calved after 1st January 1832—Ten Sovereigns.

XXIV. For the best two Fat Oxen, calved after 1st January 1833—Ten Sovereigns.

XXV. For the best two Steers, calved after 1st January 1834, bred by the exhibitor—Seven Sovereigns.

ANY BREED.

XXVI. For the best Fat Ox, of any breed, pure or cross, except the Short-horned, calved after the 1st January 1832—Ten Sovereigns.

For the second best two ditto—Seven Sovereigns.

§ II. HORSES.

CLASS I. For the best Draught Stallion, not exceeding eight years and five months old—Twenty Sovereigns.

It is a condition attached to this premium, that the exhibitor shall be obliged to let out the Prize Horse for season 1837, to serve within the four counties, provided the owner of the Horse shall, within two months after the Show, be guaranteed in a subscription of Sixty Sovereigns; the number of Mares to be served not to exceed Sixty, and the charge to be One Sovereign for each. Ten of the Mares exhibited at the Show, to be recommended by the judges, are to have a preference of service.

II. For the best Breeding Mare for Agricultural purposes, not exceeding twelve years old, and which shall have had at least one foal—Seven Sovereigns.

For the second best ditto—Five Sovereigns.

III. For the best Filly for Agricultural purposes, not exceeding thirty-four months old—Five Sovereigns.

§ III. SHEEP.

BLACK-FACED BREED.

CLASS I. For the best two Tups, not exceeding forty-five months old—Five Sovereigns.

II. For the best pen of five Ewes, not exceeding five years and

seven months old, selected from a regular breeding stock of not fewer than 100, and the pen having reared Lambs to 1st of July—Five Sovereigns.

III. For the best pen of five Gimmers—Five Sovereigns.

IV. For the best pen of five Fat Wedders, not exceeding four years and seven months old—Three Sovereigns.

V. For the best pen of five Fat Wedders, not exceeding five years and seven months old—Five Sovereigns.

LEICESTER BREED.

VI. For the best Tup, not exceeding forty-five months old—Five Sovereigns.

VII. For the best Pen of three Ewes, of any age—Five Sovereigns.

VIII. For the best pen of three Wedders, not exceeding thirty-two months old—Three Sovereigns.

IX. For the best pen of three Dinmonts, not exceeding twenty months old—Three Sovereigns.

X. For the best pen of three Gimmers—Three Sovereigns.

XI. For the best pen of three Wedder Lambs—Three Sovereigns.

XII. For the best pen of three Ewe Lambs—Three Sovereigns.

CHEVIOT BREED.

XIII. For the best two Tups, not exceeding forty-five months old—Five Sovereigns.

XIV. For the best pen of five Ewes, not exceeding five years and seven months old, selected from a regular hirsle of not fewer than 100, and the pen having reared Lambs to the 1st of July—Five Sovereigns.

XV. For the best five fat Wedders, not exceeding four years and seven months old—Three Sovereigns.

CROSS BREED.

XVI. For the best pen of five fat Wedders, of any Cross, not exceeding four years and seven months old, value of wool and carcass being considered—Three Sovereigns.

§ IV. SWINE.

CLASS I. For the best Boar—Three Sovereigns.

II. For the best Sow—Two Sovereigns.

III. For the best brood Sow, the property of a Cottar or Tenant, not paying above L.15 yearly rent, and in whose possession she has had a litter—Two Sovereigns.

IV. For the best three Pigs, not exceeding forty weeks old—Two Sovereigns.

§ V. WOOL.

CLASS I. For the best sample of Combing Wool of seven fleeces—Five Sovereigns.

II. For the best ditto of Short Wool, of the Cheviot breed, of seven fleeces—Five Sovereigns.

III. For the best ditto of Wool of the Black-faced Breed, of seven fleeces—Five Sovereigns.

NOTE.—The samples of wool are to be shewn on the day which shall be fixed for the Wool Fair at Perth, in July next, and the above premiums for the best samples will be then awarded. The owners of the successful samples will also exhibit them on the day of the General Show of Stock.

Competitors for Wool Premiums are required to state the number of sheep of which the flock consisted from which the sample is taken; the gross quantity clipped; and, if sold, the price obtained; and in regard to the combing wool, whether it is of the new Leicester, Cotswold, or of any cross of these breeds.

§ VI. EXTRA STOCK, IMPLEMENTS, ROOTS, AND SEEDS.

For Extra Stock of any kind, not shewn for any of the above premiums, and not exceeding in one lot five Cattle or ten Sheep, and for Implements, Roots, Seeds, &c., premiums will be awarded and apportioned, by the Committee and Judges, in Money, Plate, or Honorary Medals, to the value in whole of Fifty Sovereigns.

GENERAL REGULATIONS FOR THE SHOW AT PERTH.

1. The Competition will take place at Perth, on Friday, the 7th of October 1836. The certificates of Stock to be shewn must be lodged with the Secretary, or transmitted so as to reach him at Perth, or at his Office in Edinburgh, on or before Thursday the 22d September.

2. The Competition is open to Stock from any part of the United Kingdom.

3. The name, residence, and post-town of the Exhibitor, the name of the Breed, the number of the class in which the animals are to be exhibited, their age, and, in the case of Fat Stock, the kind of food on which they have been fed, must be regularly certified, and the certificate signed by the Exhibitor, agreeably to the form annexed, must be duly lodged fourteen days before the day of Exhibition. The pedigree of the Stock, so far as known, must also be given. A list of the stock entered will be made up by the Secretary on Friday the 23d September, and no Stock will be allowed to compete which is not included in that list.—*Printed forms* of certificates may be had by application at the Society's Hall, Edinburgh; or at the office of Mr Turnbull, Secretary to the Perth Farming Society, Perth,

on or before the 20th of September. The Secretary, or his Clerk, will be at Perth on the 22d September, to answer inquiries, attend to details, and to receive certificates. In the mean time, certificates may be lodged with him at Edinburgh, or with Mr Turnbull at Perth. The certificates so lodged, are not to be communicated to third parties until after they have been officially laid before the Committee by the Secretary.

4. A responsible person, on the part of the Exhibitor, must attend at the Secretary's Office at Perth, *on or before* the 6th October, (the day preceding the Show), at 12 noon, to give explanation, if it should be required, to receive orders or warrants of admission for the Stock of which they are in charge, and all necessary instructions in matters of details, at the competition. The person or persons so attending must be acquainted with the various particulars required to be certified regarding the Stock of which they are in charge, more especially the mode of feeding in the case of Fat Stock; and it shall be competent to the Committee, if they shall see fit, to require the Exhibitor, or the person in charge of the Stock, to confirm the certificates on oath on the day of competition.

5. In estimating the ages above prescribed for competing Stock, the following rules are to be observed, viz.—The Age of Cattle, in all the Classes, will be calculated from the 1st of January of the year in which they were calved; of Horses from the 1st of May of the year in which they were foaled; and of Sheep from the 1st of March of the year in which they were lambed.

6. It is required that the Stock shall have been *bona fide* the property and in possession of the Exhibitor, from 1st May 1836. Evidence must be produced, if desired, that the Stallions and Bulls for which Premiums are awarded, have had produce during the preceding year; provided they are four years old and upwards.

7. No Cattle fed on distillery or brewers wash or grains (which are accessible to a few competitors only) will be allowed to compete. Cows exhibited for Premiums must have had a calf, or be in calf, during the year 1836.

8. A ticket or order will be delivered by the Secretary on or before the 6th October (the day preceding the Show), to the person in charge of each lot, for its being received into the Show Yard; and no Stock whatever can come within the premises without such warrant. One servant only for each lot can be admitted, who must afterwards continue in charge of that lot in the Show Yard. Bulls must be secured by a ring or screw in the nose, with a chain or rope attached, otherwise they cannot be admitted into the Show Yard. There are screws for temporary use, which competitors will find it convenient to provide for bulls that have not been usually ringed.

9. The distance each animal travels to the Show, and, in the case of Fat Stock, the date of being put to fatten, to be mentioned.

10. A competitor may shew more than one lot in any Class. It shall not be competent to enter a lot in one Class, and afterwards to withdraw it for competition in another Class, unless by directions of the Committee. An animal having already gained the first premium in his Class, at any of the Society's General Shows of Stock, which have been held at Edinburgh, Glasgow, Perth, Dumfries, Inverness, Kelso, Stirling, Aberdeen, or Ayr, is not to be shewn again in competition in the same Class, but may be exhibited as Extra Stock.

11. All persons intending to exhibit Extra Stock, must intimate to the Secretary, and describe the Stock fourteen days before the exhibition. Stock which cannot be shewn in any competing Class, may be exhibited as Extra Stock. If any lot of Fat Stock, for which a competing Class is open, is to be entered as Extra Stock,

from an impression on the part of the Exhibitor that they are too young to compete in the Classes open to them, the Judges of extra Stock are directed to notice them specially, provided they possess merit.

12. The competing Stock will be classed and distinguished by *Tickets or Numbers* to be affixed to each Lot, immediately after they are placed in the Show Yard, corresponding to the list made up by the Secretary ;—by this arrangement the owner's name is not known to the Judges.

13. The Committee of the Society appointed to conduct the arrangements for the Show, will appoint skilful persons to act as Judges. These will be divided into sections, to judge of the Breeds and Stock with which they are best acquainted, and in order to render the inspection short, so as the public may be permitted to enter the Show Yard as early as possible. The Judges, in forming their opinion, will particularly attend to the instructions to be delivered for their guidance.

14. A Member of the Committee, or of the Deputation of Directors, will be appointed to attend each section of the Judges, and who, along with the Judges, shall be admitted into the Show Yard, at ten o'clock precisely. A servant provided with Tickets, upon which shall be written in legible characters "First Premium" or "Second Premium," will be in attendance on the Member of the Committee so appointed. The Judges shall immediately proceed to examine and decide on the merits of the Stock ; and as soon as a section shall determine which animal or animals are entitled to the Prizes in their respective Classes, the Member of the Committee or Deputation of the Directors shall forthwith direct the servant in attendance to affix the Prize Ticket on the animal, and the Member of the Committee or Deputation is to be responsible that they are labelled accordingly, in order that the public may have the earliest opportunity to examine the points of the prize Cattle. When the inspection is finished, the Judges shall sign and give in their Reports to the Committee, and their award shall be final, provided no valid objection is stated against the Prize animals' right to compete in their respective Classes.

15. To prevent confusion, and to afford the time necessary for placing the Stock in the Show Yard, the different lots must be brought to the ground at or before eight o'clock in the morning. On their arrival at the gate, instructions will be given as to the particular part of the Show Yard to be occupied by each Class. The Stock will be withdrawn, and the Show Yard shut, at four o'clock.

16. Persons intending to exhibit Implements, Roots, or Seeds, must communicate with the Secretary, and lodge with him a memorandum descriptive of the articles to be shewn, at least five days before the meeting.

Finally, no change can, under any circumstances, be made upon the General Regulations established by the Society for Agricultural Meetings and General Shows of Live Stock, unless regularly submitted and approved of at a meeting of the Directors in Edinburgh, and duly intimated to Competitors.

His Grace the Duke of Gordon, G. C. B, the President of the Society ; and the other Most Noble and Right Honourable the Vice-Presidents, the Lord Lieutenants, Vice-Lieutenants, and Conveners of the Counties, with an adequate number of the Members of the Society, to be named at the meetings on 30th April, by the four counties more immediately connected with the Show, together with the Secretaries of the Local Agricultural Associations, have been appointed a Committee for regulating all details connected with the Agricultural Meeting and General Show of Live Stock at Perth. The Right Honourable Lord Kinnaird, in his absence John Richardson, Esq. of Pitfour, to be Convener of the Committee.

A deputation of the Directors of the Society will be at Perth two days before the meeting.

FORM OF CERTIFICATE BEFORE REFERRED TO AS APPLICABLE TO
FAT OXEN.

I near the post town of , in the county of , do certify, That my Ox, (or Oxen as the case may be) of the breed to be shewn at the General Show of Live Stock at Perth, for the Premium in Class was bred by Mr of ; he was calved after 1st January 18 , and is now years and months old, and was fed by me on . He has not at any time been fed on distillery or brewer's wash or grains. He will have to travel on foot (or by steam or other conveyance, as the case may be) miles, or thereby, from the place of feeding to the Show at Perth. He was first put up to fatten on or about the day of . Witness my hand this day of 1836.

(Signature of the Exhibitor.)

Any observations as to the animal's appearance, and state of flesh when put up to feed, or other particulars which the Exhibitor may think material, and more especially the pedigree, may be subjoined to the above certificate. The certificates for Breeding Stock, and for Horses, Sheep, and Pigs, will be varied in conformity to the regulations applicable to these descriptions of Stock.

If the lot has not been bred by the Exhibitor, it is particularly desired that the Breeder, if known, may be mentioned.

INSTRUCTIONS TO THE JUDGES.

1. Upon their arrival in the Show-Yard, the Judges will assemble in the apartment provided for their accommodation, until it is intimated to them that all arrangements preparatory to their proceeding to view the Stock are completed.

2. Without inquiry as to the names of parties or places, the Judges are to determine by reference to the *numbers* affixed to each lot by the Secretary. The Judges, in their report, will name not only those animals entitled to the Premiums, but also the others in each class which they may consider most worthy of notice.

3. The Secretary is understood to have satisfied the Committee of the regularity and correctness of the Certificates lodged, before granting the warrant for Exhibition; and the Judges, therefore, must proceed upon that evidence, without reference to any other person. They will state, however, for the information of the Committee, if any of the Stock, in their opinion, does not come within the regulations prescribed for the Competition, so that such farther inquiry may be made as the Committee may think necessary.

4. In forming their judgment, the Judges will have regard to the symmetry, early maturity, purity, size, and general qualities characteristic of the different breeds they have to judge of; making due allowance for age, feeding, and circumstances peculiar to the cases which come before them. They shall not award Premiums for Cows, Bulls, or Heifers which shall appear to have been fattened for the butcher, the object being to have superior animals of these descriptions, for the purpose of breeding.

5. In no case shall a Premium be adjudged unless the Judges shall deem the Lot to have *sufficient merit*; more especially if one Lot only is presented for any of the Premiums.

6. Having formed their opinion, the Judges will sign and deliver their Report; and, having done so, they are not afterwards to propose any change. In the event of a difference of opinion, the majority shall be conclusive. When the signed Report is delivered over to the Committee, the duty of the Judges shall cease, and it will devolve on the Committee finally to award the Premiums.

CLASS X.**GENERAL SHOW OF LIVE STOCK,****AND****AGRICULTURAL MEETING AT DUMFRIES IN 1837.**

THE Highland and Agricultural Society of Scotland having resolved to hold the General Show of Live Stock and Agricultural Meeting for 1837 at Dumfries, the following Premiums are offered to be then awarded by the Society, aided by the liberal Donations made by the counties of Dumfries, Kirkcudbright, and Wigton, and by the town of Dumfries :—

§ I. CATTLE.**GALLOWAY BREED.**

CLASS I. For the best Bull, calved between 1st January 1832 and 1st January 1835—Twenty Sovereigns, or Plate of that value.

For the second best ditto—Ten Sovereigns.

To the *Breeder* of the best Bull in this class—The Honorary Silver Medal.

It is a condition attached to the Premiums in Class I. that the exhibitors shall be obliged to let out the Prize Bulls to serve at least Forty Cows, during the season of 1838, within such portion and at such places of the three counties of Dumfries, Kirkcudbright, and Wigton, as the Local Committee shall fix, on payment of Five Shillings for each Cow.

II. For the best Bull Stirk, calved after 1st January 1836—Ten Sovereigns.

III. For the best two fat Oxen, calved after 1st January 1834—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

IV. For the best single fat Ox, calved after the 1st of January 1833—Seven Sovereigns.

V. For the best two Spayed Heifers, fat, calved after the 1st of January 1834—Ten Sovereigns.

VI. For the best single Spayed Heifer, fat, calved after the 1st of January 1833—Seven Sovereigns.

VII. For the best breeding Cow, calved prior to the 1st of January 1835—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

VIII. For the best two Queys, calved after the 1st of January 1835—Ten Sovereigns.

For the second best two ditto—Seven Sovereigns.

For the third best two ditto—Five Sovereigns.

IX. For the best lot of Stirks, calved after the 1st of January 1836, and not under one-half of those bred on the farm, nor fewer than four in number—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

ABERDEEN OR ANGUS POLLED BREED.

X. For the best fat Ox, calved after the 1st of January 1833—Ten Sovereigns.

For the second best ditto—Seven Sovereigns.

SHORT-HORNED BREED.

XI. For the best Bull, of the pure short-horned breed, calved between 1st January 1832 and 1st January 1835—Twenty Sovereigns.

For the second best ditto—Ten Sovereigns.

For the *Breeder* of the best Bulls in this Class—The Honorary Silver Medal.

It is a condition attached to the Premiums in Class XI., that the exhibitors shall be obliged to let out the Prize Bulls to serve at least forty Cows, within the three Counties, during the season 1838, on payment of ten shillings and sixpence for each Cow.

XII. For the best Bull Stirk, calved after the 1st January 1836—Seven Sovereigns.

XIII. For the best Cow of any age—Ten Sovereigns.

XIV. For the best fat Ox, calved after the 1st January 1835—Seven Sovereigns.

XV. For the best Heifer, calved after the 1st January 1835—Seven Sovereigns.

AYRSHIRE BREED.

XVI. For the best Bull, calved between 1st January 1832 and 1st January 1835—Fifteen Sovereigns.

To the *Breeder* of the best Bull in this Class—The Honorary Silver Medal.

A similar condition is attached to the Premium in Class XVI. as above intimated in reference to Class I.

XVII. For the best Bull Stirk, calved after 1st January 1836—Five Sovereigns.

XVIII. For the best Milch Cow, calved prior to 1st January 1834—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

XIX. For the best two Queys, calved after 1st January 1835—Seven Sovereigns.

For the second best ditto—Five Sovereigns.

WEST HIGHLAND BREED.

XX. For the best fat Ox, calved after 1st January 1833—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

ANY BREED.

XXI. For the best fat Ox, of any breed, pure or cross, calved after 1st January 1833, the particulars of the breed and age being specified—Ten Sovereigns.

§ II. HORSES.

CLASS I. For the best Stallion, from three to twelve years old, for the improvement of the breed of Draught Horses—Twenty Sovereigns.

II. For the best Stallion, from three to twelve years old, for breeding Horses for coach or chariot—Twenty Sovereigns.

NOTE.—It is a condition attached to these two premiums, that the exhibitors shall be obliged to let out the Prize Horses for season 1838, to serve within such portion and at such places of the district as the Local Committee may fix; the number of Mares to be served not to exceed eighty, and the charge to be One Sovereign, and 2s. 6d. for each.

III. For the best Mare, not exceeding twelve years old, for breeding Draught Horses, and which shall have been at least one year in the possession of the competitor—Ten Sovereigns.

IV. For the best three-years old Draught Gelding—Five Sovereigns.

V. For the best three-years old Filly—Five Sovereigns.

§ III. SHEEP.

LEICESTER BREED.

CLASS I. For the best Tup, of the new Leicester Breed, not exceeding five years old—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

II. For the best shearling Tup of the same breed—Five Sovereigns.

It is a condition attached to the premiums for Tups in Classes 1, 2, 5, and 10, that the exhibitors shall be obliged to let out the Prize Tups to serve, within the three counties, such number of Ewes at such hire as the practical judges of the class in which the animal is shown shall declare to be reasonable. If the exhibitor reside within the district, he shall have preference of service for his own flock.

III. For the best pen of three Ewes, not exceeding four years old—Five Sovereigns.

IV. For the best pen of three Fat Wedders, not exceeding twenty months old—Three Sovereigns.

CHEVIOT BREED.

V. For the best three Tups, not exceeding forty-three months old—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

VI. For the best pen of ten Ewes, not exceeding six years old, selected from a regular breeding stock of not less than 200 rearing lambs of that season till the middle of July, and being kept with the rest of the stock till at least the Whitsunday preceding—Ten Sovereigns.

For the second best pen of ditto—Five Sovereigns.

VII. For the best pen of ten Gimmers, selected from a regular breeding stock of not less than 200 Ewes, and to be kept with the breeding stock till the time of the Show—Five Sovereigns.

VIII. For the best pen of five Fat Wedders, not exceeding fifty-six months old—Five Sovereigns.

IX. For the best pen of five ditto, not exceeding thirty-two months old—Five Sovereigns.

BLACK-FACED BREED.

X. For the best three Tups, not exceeding forty-three months old—Ten Sovereigns.

For the second best three ditto—Five Sovereigns.

XI. For the best pen of ten Ewes, not exceeding six years old, selected from a regular breeding stock of not less than 200 rearing lambs of that season till the middle of July, and being kept with the rest of the stock till at least the Whitsunday preceding—Ten Sovereigns.

For the second best pen of ditto—Five Sovereigns.

XII. For the best pen of ten Gimmers, selected from a regular breeding stock of not less than 200 Ewes, and to be kept with the breeding stock till the time of the Show—Five Sovereigns.

XIII. For the best pen of five fat Wedders, not exceeding fifty-six months old—Five Sovereigns.

XIV. For the best pen of five ditto, not exceeding thirty-two months old—Five Sovereigns.

CROSS BREED.

XV. For the best pen of five fat Wedders, a cross between Cheviot Ewes and Leicester Tups, not exceeding twenty months old—Five Sovereigns.

For the second best ditto—Three Sovereigns.

XVI. For the best pen of five fat Wedders, a cross between the Black-faced Ewes and Leicester Tups, not exceeding twenty months old—Five Sovereigns.

XVII. For the best pen of five fat Wedders, of any cross, under thirty-two months old—Five Sovereigns.

XVIII. For the best pen of ten Lambs, from Cheviot Ewes, by Leicester Rams, dropt subsequently to 1st March 1837, and shewn by the breeder—Five Sovereigns.

XIX. For the best pen of ten Lambs, from Black-faced Ewes by Leicester Rams, dropt subsequently to 1st March 1837, and shewn by the breeder—Five Sovereigns.

XX. For the best pen of ten Lambs, from Cheviot or Black-faced ewes, by any other description of ram than the Leicester, dropt subsequently to the 1st March 1837, and shewn by the breeder. The ram to be shewn along with the lambs—Five Sovereigns.

§ IV. SWINE.

CLASS I. For the best Boar, not under twelve months, and not exceeding four years old—Eight Sovereigns.

For the second best ditto—Five Sovereigns.

II. For the best breeding Sow, not under twelve months, and not exceeding four years old—Six Sovereigns.

For the second best ditto—Four Sovereigns.

III. For the best two Pigs, not exceeding forty weeks old—Five Sovereigns.

§ V. EXTRA STOCK, IMPLEMENTS, ROOTS, SEEDS, &c.

For Extra Stock of any kind, not shewn for any of the above premiums, and not exceeding in one lot five Cattle, or ten Sheep ;

and for Implements of Husbandry, Roots, Seeds, &c, Honorary Medals or Money Premiums will be awarded to the value, in the whole, of Seventy Sovereigns.

§ VI. PRODUCTS OF LIVE STOCK.

CURING BUTTER.

CLASS I. To the owner of any Dairy in the counties of Dumfries, Kirkcudbright, and Wigton, who shall have made and cured the best quality of Butter for the market, not being less than two cwt., during the season 1837—Five Sovereigns.

For the second best quality of ditto—Three Sovereigns.

MAKING CHEESE.

II. To the person in the counties of Dumfries, Kirkcudbright, or Wigton, who shall produce the best specimen of sweet or full milk Cheese, made of any variety that he finds most profitable for the market—Five Sovereigns.

For the second best ditto—Three Sovereigns.

The whole quantity of the variety of Cheese produced, made by each Competitor during the season, must not be less than one cwt.; and a certificate on oath must be lodged, that two or more Cheeses produced are a fair average of the kind competing, made in that year by the Competitor.

III. To the owner of any Dairy in the counties of Dumfries, Kirkcudbright, or Wigton, who shall have made for sale the best quality of Cheese from skimmed milk, not being less than one cwt., during the season 1837—Five Sovereigns.

For the second best quality of ditto—Three Sovereigns.

In the event of two or more competing lots being deemed equal in quality, the Premium will be awarded to the greater quantity.

§ VII. SWEEPSTAKES.

Sweepstakes of One Guinea each are proposed in each of the various descriptions and ages of Stock above described, to close and name before the meeting, according to the regulations to be afterwards agreed on. The Stock entered for the Premiums may be entered also for the Stakes.

§ VIII. WOOL.

CLASS I. For the best sample of Combing Wool of seven fleeces—Five Sovereigns.

II. For the best ditto of Short Wool of the Cheviot Breed of seven fleeces—Five Sovereigns.

III. For the best sample of Wool of the Black-faced Breed of seven fleeces—Five Sovereigns.

Competitors for these Premiums are required to state the number of Sheep of which the flock consisted from which the sample is taken, the gross quantity clipped, and, if sold, the price obtained; and, in regard to the Combing Wool, whether it is of the New Leicester, Cotswold, or of any cross of these breeds.

GENERAL REGULATIONS FOR THE DUMFRIES MEETING.

The Competition will take place at Dumfries in the end of September or beginning of October 1837. The particular day will be afterwards intimated.

The Competition is open to stock from any part of the United Kingdom.

It is required that the stock shall have been the property of the Exhibitors from 1st May 1837.

No cattle fed on distillery or brewers' wash or grains will be allowed to compete for premiums in any of the Classes. Cows exhibited for premiums must have had a calf during the year 1837.

In estimating the ages of stock, the same rules are to be observed as are fixed by the 5th article of the Regulations for the Perth Show in 1836.

The usual Regulations of the Society with respect to Shows of this kind, in so far as applicable to the Dumfries Meeting, must be strictly adhered to; and in particular the Judges shall be instructed not to award Premiums to Cows, Bulls or other breeding stock, which shall appear to have been fattened for the butcher—the object being to encourage such stock for the purpose of breeding. The places at which the prize Stallions, Bulls, and Tups are to serve, will be fixed by the Committee.

For the other Regulations generally, intending competitors are referred to those published for the Perth Meeting in 1836.

THE VETERINARY SCHOOL.

The Establishment is now in its Thirteenth Session, under the Lecturer appointed by the Society, Mr Dick, a Graduate of the Veterinary College of London.—Students receive instruction in the anatomy and diseases of the horse, and other domestic animals, in the best system of treatment and cure, in stable management, and in the most approved and scientific modes of shoeing. The students are sent to the class by Local Agricultural Associations, or attend on their own account. The hour of Lecture is accommodated to the convenience of students attending the Agricultural and other classes in the University. Those students who attend two courses, and are afterwards found qualified at the annual Examination by the Committee of Medical Examinators, receive Certificates.

Mr Dick occasionally delivers a popular course of lectures to a class of gentlemen. It may be also observed, that several of the principal Lecturers in different branches of Medical Science, have for some years given free admission to their classes, to those Veterinary Students who intend to practise.

The Lectures and Demonstrations for the Session 1836-37, will be commenced in November next, at the Lecture-room in Clyde Street, Edinburgh.

SPECIMENS OF THE DIFFERENT QUARRIES AND MINES OF SCOTLAND.

The Society, considering it to be a very important step towards the attainment of a Geological and Mineralogical Survey of Scotland,—and a measure otherwise of general utility and interest,—that the nature of the Rocks and other Mineral produce should be ascertained with certainty and precision, by the collection of a complete series of specimens, to be deposited and topographically arranged for reference in its Museum, would esteem it not only as a favour to the Society, but as a public benefit to the country, if the proprietors of estates, or the owners or lessees of the quarries or mines, worked in Scotland, would cause specimens of the different Rock-formations, Ores, and other Mineral productions of their respective districts, to be transmitted accordingly to the Society's Museum in Edinburgh.

These specimens need not be more than three inches square, by one and a half or two inches at most in thickness; and it is desirable that each package should be accompanied by the donor's name, and a short account of the locality of the quarry or mine from which the specimens have been taken; together with a descriptive catalogue of the specimens transmitted, each of which must have the corresponding name or number pasted upon it. If several varieties of stone, &c. are seen in the same quarry, specimens of each should be sent, numbered according to their order of succession, marking the uppermost No. 1, and thence descending in regular order with Nos. 2, 3, 4, &c.; and their exact positions may be shewn by a rough sketch or diagram in this form.

	Soil.
No. 1.	Shale.
2.	Sandstone.
3.	Coal.
4.	Sandstone.
5.	Shale.
6.	Coal.
7.	Shale.
8.	Limestone.

Packages to be addressed to the care of Mr Slight, Curator of the Museum, at the Society's Hall.

NOTE.—The local Associations that may have been formed in different parts of the country for the encouragement of the study of Natural History, may render themselves of the greatest service in forwarding a work of so much national importance, by directing and superintending the collection and transmission of these specimens, as far as their influence may extend in the districts with which they may be respectively concerned. Any communications from them on the subject, addressed to the Secretary, will be thankfully acknowledged.

By order of the Directors,

CHARLES GORDON, *Secretary.*

PREMIUMS

OFFERED BY

**THE HIGHLAND AND AGRICULTURAL
SOCIETY OF SCOTLAND,**

FOR PROMOTING

**AGRICULTURE AND INTERNAL IMPROVEMENT
IN SCOTLAND,**

IN

CONTENTS.

PRELIMINARY NOTICE,	Page 4
Notice to Candidates, and General Regulations of Competition,	5-6
Office-bearers and Directors,	7-8
Chairmen of Standing Committees,	8
 CLASS I.—AGRICULTURAL MACHINERY,	 9
1. Application of Steam to the Cultivation of the Soil,	9
2. Invention or Improvement of Implements of Husbandry,	10
 CLASS II.—ESSAYS AND REPORTS ON VARIOUS SUBJECTS,	 11
1. Geological Surveys,	11
2. Reports on Coal Districts,	12
3. Mines and Minerals,	14
4. Contents of Peat Mosses,	14
5. Improvements on Thrashing Machines,	15
6. Feeding of Farm-Horses on Raw and on Prepared Food,	15
7. Management of Sheep with a view to the Improvement of the Fleece,	16
8. Rearing and Fattening Poultry,	16
9. Manufacture of Paper from the Fibre of Indigenous Vegetables,	17
10. Insects injurious to Vegetation,	17
11. Reservoirs of Water for Agricultural Purposes,	18
12. Points in Cattle indicating Disposition to Fatten early,	18
13. Point in Cattle of the West Highland Breed indicative of Disposition to Fatten,	19
14. Preserving Potatoes,	19
15. Domestic Dyes,	20
16. Effects of Wood on Climate,	20
17. Subsoil and Trench Ploughing,	21
18. Reports on Irrigation,	21
19. Forest Planting,	22
20. Sheep Pastures at High Elevations,	22
21. Improved Sheep-Salve,	23
22. Extirpating Ferns from Pastures,	24
23. Reports on Dairy Management in Scotland,	25
24. Reports on Improved Rural Economy Abroad,	25
25. Honorary Premium for Reports on Certain Districts in Scotland, Conditions of Competition for Essays and Reports,	25 27
 CLASS III.—WASTE LANDS,	 27
1. Improvement of a Specified Extent of Land by Tillage,	27
2. Improvement of a Specified Extent of Land for Pasture,	28
3. Reclaiming Land from the Sea,	29
4. Reclaiming Land by Embanking Rivers,	29
 CLASS IV.—CROPS AND CULTURE,	 29
1. New Plants adapted to Field Culture,	29
2. Early Angus Oats of the Greatest Weight,	30
3. Ploughing Competitions	30

	Page
CLASS V. PASTURES,	31
1. Management of Pasture Lands,	31
CLASS VI.—LIVE STOCK—DISTRICT COMPETITIONS,	32
§ I. CATTLE,—	
Premiums for Improving the Breed of Cattle in various Dis-	
tricts,	32-38
§ II. WORK HORSES,—	
Premiums for Improving the Breed of Draught Horses in va-	
rious Districts,	38-40
§ III. SHEEP AND WOOL,—	
Premiums for Improving the Breed of Sheep in various Dis-	
tricts,	40, 41
§ IV. SWINE,—	
Premiums for Improving the Breed of Swine in various Dis-	
tricts,	41, 42
CLASS VII. PRODUCTS OF LIVE STOCK,	42
§ I. CURING BUTTER,	42
§ II. MAKING CHEESE,	44
CLASS VIII. COTTAGES,	45
1. Premiums for the Best Kept Cottages and Gardens,	45
2. Medals to Cottagers,	46
3. Premiums to Cottagers for promoting attention to the Cultiva-	
tion and Management of Bees,	47
CLASS IX. WOODS AND PLANTATIONS,	48
1. Honorary Premium for extensive Planting,	48
2. Reports on recent Plantations,	48
3. Native Fir Woods,	48
4. Fir Plantations,	49
5. Collecting the Seeds of the Scots Fir or Pinus Sylvestris from	
Native Trees in Scotland,	49
6. Importing the Seeds of the Pinus Sylvestris, collected from Trees	
in the Native Forests of the Continent,	49
7. Introduction of new Forest Trees into Scottish Plantations,	50
8. Introduction of Forest Trees not yet known in a living state in	
Scotland,	50
9. More extended introduction of known species of the Fir Tribe,	51
CLASS X. GENERAL SHOW OF LIVE STOCK, AND AGRICULTURAL	
MEETING AT DUMFRIES IN 1837,	52
Cattle—Horses—Sheep—Swine—Extra Stock, Imple-	
ments, Roots, Seeds, &c.—Products of Live Stock—	
Sweepstakes—Wool,	52-57
General Regulations for the Show at Dumfries,	58
CLASS XI. GENERAL SHOW OF LIVE STOCK, AND AGRICULTURAL	
MEETING AT GLASGOW IN 1838,	61
Cattle—Horses—Sheep—Swine—Extra Stock, Imple-	
ments, Roots, and Seeds—Products of Live Stock—	
Wool,	61-67
NOTE REGARDING THE VETERINARY SCHOOL,	67
NOTE REGARDING THE TRANSMISSION OF SPECIMENS OF THE DIFFERENT	
QUARRIES AND MINES OF SCOTLAND,	68

PRELIMINARY NOTICE.

The business of the **THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND** is conducted by a President, Four Vice-Presidents, Thirty Ordinary, and Ten Extraordinary Directors, a Treasurer, an Honorary Secretary, and a Secretary, to which last all communications are addressed. The Ordinary Directors are subdivided into Committees for the dispatch of business, assisted occasionally by those Ordinary Members most conversant with the subjects to be discussed. The Report of each Committee is brought before the Directors collectively for farther procedure, and these proceedings are again submitted for approbation to a half-yearly General Meeting of the Society. One of the General Meetings is, by the Charter, appointed to be holden on the second Tuesday of January; the other on such lawful day in the months of June or July as the Directors may fix. New Members are admitted at either of these General Meetings by ballot. They pay a small annual contribution of £1 : 3 : 6, or, in their option, and in full of all future claims, a life subscription of Twelve Guineas. The Annual Subscription is payable in advance, and is expected to be so paid or remitted, by the Members who are liable in it, without expense to the Society. All Meetings of Directors, or Committees, are open; and at these any member may attend and deliver his opinion on the subjects under consideration, though, in cases of division, the Directors or Members of the Committees only are entitled to vote. Members have access to the Society's Library, which is annually increasing, by the purchase or donation of books connected with the purposes of the Institution.

When the Highland and Agricultural Society of Scotland was instituted in the year 1784, the object chiefly contemplated was the improvement of the Highlands, and hence the name—**THE HIGHLAND SOCIETY OF SCOTLAND**—which it then assumed. But the great increase in the number of its Members since that time, the happy management of its funds, and the change in the general state of the country, have long enabled it to extend the design of its first institution, and direct attention to every part of North Britain where industry might be excited or the useful arts improved. In accordance with this extension of the purposes of its institution, the Society, in the Supplementary Charter lately obtained, has been named **THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND**.

The Society has, neither by its Charters of Incorporation, nor by its practice, been limited in its patronage to any one department of industry; but it has regarded, as the fitting objects of encouragement, every application of useful labour which might tend to the general good. But although its patronage be thus extended as regards its objects, circumstances have arisen to modify, in some cases, the application of it. The establishment of certain Boards, for the encouragement of the Herring Fishery, and the like, has induced the Society to restrict its original views, and to devote its attention, and apply its funds, in a more special manner, to other objects, and chiefly to Agricultural and Rural Economy in their various branches.

In fulfilment of its purposes, the Society is every year accustomed to offer and award a variety of Premiums, as the means of eliciting and diffusing knowledge

as incitements to industry, or as the rewards for useful undertakings. These relate to every subject which may be supposed to fall within the plan of the Institution:—such are, the Improvement of Waste Lands by Tillage, by Irrigation, or by Draining, the development of the Mineral Products of the country, the extension of Plantations, as the objects of ultimate profit, or of present embellishment and shelter,—the improvement of the breeds of Live Stock, and of the qualities of Wool,—the encouragement of certain domestic Manufactures,—and, not the least in interest and importance, the awakening the industry of the Lower Ranks to such pursuits as shall promote their content, by ameliorating their condition. A Mechanical Department exists for rewarding the original invention or subsequent improvement of all machines and implements for Agricultural purposes, the construction of those for other branches of Rural Economy, and of some for domestic convenience. Models of these are received and preserved in the Society's Museum: and descriptions of all such as merit attention are as speedily as possible conveyed to the Public.

Although certain subjects be thus selected as the objects of experiment or discussion, the patronage of the Society is not restricted to these objects. Its purposes being the promotion of general industry and improvement, it receives with favour every beneficial communication, and every statement of facts which may admit of an useful application.

The Papers of the Society are printed periodically in "THE QUARTERLY JOURNAL OF AGRICULTURE, AND THE PRIZE ESSAYS AND TRANSACTIONS OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND," published by Messrs BLACKWOOD of Edinburgh, Mr CADELL of London, and Messrs CURRY & Co. of Dublin.

All Communications relating to Premiums, as well as Papers or Reports for publication in the Transactions of the Society, and other subjects for the consideration of the Directors, are to be addressed to CHARLES GORDON, Esq. the Secretary of the Society, at the Society's Hall, Albion Place, Edinburgh.

NOTICE TO CANDIDATES,

AND GENERAL RULES FOR COMPETITION.

WHEN subjects are specially selected for competition, it is always to be understood, 1st, That however concisely the subjects themselves be announced, ample information is required concerning them; 2^d, That this information shall be founded on experience or observation, and not on simple references and quotations from books; 3^d, That it shall be digested as methodically as possible; and, 4th, That Drawings, Specimens, or Models, adapted to a defined scale (3 inches to the foot if convenient), shall accompany writings requiring them for illustration.

Certain conditions are annexed to each of the various subjects of competition, as detailed in the List of Premiums; and these are rigidly enforced by the Society, as the only means of ensuring regularity in the conduct of the business, and of buting exact justice among the competitors.

In all Essays for competition, it is expected that when facts not generally known are stated, they are to be authenticated by proper references. Competitors in Essays shall not communicate their names, but shall transmit along with the Essays a sealed note containing their names and addresses, and inscribed on the back with some distinguishing motto or device, which shall also be inscribed on the Essay. When this regulation is neglected, such Essay shall not be received in competition. If the Essayist has formerly gained a premium from the Society for a paper communicated by him, it is recommended that his subsequent Essay shall be written in a different hand from that of the former successful paper.

None of the sealed notes, except those which bear the distinguishing motto or device of the Essays found entitled to premiums, will be opened, and the sealed note will not in any instance be opened, without the consent of the author, unless a Premium equal to at least one-half of the sum offered shall have been adjudged. But should no application be made for the paper on or before the 1st of March in each year, it will be held as belonging to the Society on the terms proposed. Such Essays as are not found entitled to any Premium, will, with the sealed notes, be returned to the authors, if required. The Society is to be at liberty to publish the Essays, or extracts from them, for which the Premium, or part of it, shall be awarded.

Candidates are requested to observe, that, in any instance, when Essays, Reports, or Certificates are unsatisfactory, the Society is not bound to give the reward offered; and that in certain cases power is reserved of giving such part only of a Premium as the claim may be adjudged to deserve; but competitors may feel assured that the Directors will always be inclined to judge liberally of their several claims.

In all Reports of Experiments relating to the Improvement or Management of Land, it is expected that the expenses shall be accurately detailed. When Machines or Models are transmitted, it must be stated whether they have been elsewhere exhibited or described.

In all Premiums offered, having reference to Weight or Measure, the New or Imperial Standards are alone to be understood as referred to; and Competitors are required to state their calculations according to these, the only legal standards, otherwise the claim will not be entertained.

When the Premiums are awarded in Plate, the Society will, in such cases as the Directors may see proper, allow them to be paid in money, on the application of the successful Candidates.

The Premiums awarded by the Society are payable after the 10th of February, for the preceding year.

ESTABLISHMENT FOR 1837.

President.

HIS GRACE GEORGE GRANVILLE, DUKE OF SUTHERLAND.

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THE MOST NOBLE JOHN WILLIAM, MARQUIS OF LOTHIAN.

THE MOST NOBLE JOHN, MARQUIS OF BUTE.

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ACCORDING TO PRIORITY IN DATE OF ELECTION.

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 JOSEPH MURRAY, Esq. of Ayton.
 Sir JOHN CAMPBELL of Ardnamurchan, Bart.
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Publications and Papers,... DAVID LOW, Esq. F. R. S. E., Prof. of Agriculture.
Mechanics,..... JOHN ROBISON, Esq. Sec. Royal Soc. Edinburgh.
Geology,..... DAVID MILNE, Esq. Advocate.
The Veterinary School,..... JOHN BURN MURDOCH, Esq. of Coldoch.
Regulations for General } G. MACMIKIN TORRANCE, Esq. of Kilsaintninian.
Shows of Live-Stock, }
The Argyll Naval Fund,... P. SMALL KEIR, Esq. of Kinmonth.

PREMIUMS, &c.

*SOCIETY'S HALL, ALBYN PLACE,
EDINBURGH, 8th Feb. 1837.*

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND does hereby advertise, That the under-mentioned PREMIUMS are to be given by the Society in the year 1837, &c.

CLASS I.

AGRICULTURAL MACHINERY.

1. APPLICATION OF STEAM TO THE CULTIVATION OF THE SOIL.

A Premium of Five Hundred Sovereigns will be awarded for the first successful Application of Steam-Power to the Cultivation of the Soil.

By the cultivation of the soil are to be understood the operations of ploughing and harrowing, or preparing the soil in an equally efficient manner, and the other purposes for which animal power is now used; and the success of the invention will be judged of in relation to its applicability to the above purposes in the ordinary situations of farms in this country, and to the saving *in time, labour, and outlay*, which it may possess over animal power, as now generally employed in the cultivation of the soil.

The merits of the invention, with reference to the conditions enumerated, will be judged of by a Committee of the Society specially appointed, and the inventor will be required to exhibit the machinery and modes of applying it, in Scotland. Mr

Gordon, the Secretary of the Society, on application of intending Competitors, will furnish any information which may be required.

The Society, in offering this Premium, does not feel it to be necessary to express opinions as to the probability of a successful application of steam to tillage, as to the means by which the object may be attained, or as to the effects which might be supposed to result from the application of such a power. But it has felt it to be a duty imposed upon it by its situation, to bring the subject in a proper manner before the country, to encourage those who are now engaged in this class of experiments, and to stimulate future invention by the offer of a premium corresponding, in some measure, to the interest and importance of the subject. Looking to the vastly extended application which has recently been made of steam as a motive power, and seeing that the difficulties which are opposed to its application to the purposes of the farm have been at least partially overcome by the efforts of individuals, it has appeared to the Society, that, without exciting expectations which may not be realized, a strong ground exists for having this possible application of steam-power made the subject of fair and satisfactory experiment.

2. INVENTION OR IMPROVEMENT OF IMPLEMENTS OF HUSBANDRY.

To the person who shall invent or improve any Instrument or Machine applicable to Husbandry or Rural Economy (other than that above referred to in No. 1.), and which, from its utility in saving labour or expense, simplicity, or cheapness of construction, or other circumstances, shall be deemed by the Society deserving of public notice--The Silver Medal, or such sum in Money as the communication shall appear to deserve.

The account of the implement must be accompanied by a model made, when convenient, to a scale of three inches to the foot, to be deposited in the Society's Museum. The model to be formed of wood or metal: and the notice or description transmitted with it must specify, according to the best of the inventor's abilities, the purpose or advantage of his invention or improvement.

CLASS II.

ESSAYS AND REPORTS ON VARIOUS SUBJECTS.

1. GEOLOGICAL SURVEYS.

Fifty Sovereigns, or a Piece of Plate of that value, will be given to any person who shall, from actual observation, execute the best Geological Survey of any County or District in Scotland (except Berwickshire, the Lower District of Morayshire, Renfrewshire, and the North of Ayrshire, already reported), by colouring accurately, and in the fullest detail that the scale will admit of, a portion of Thomson's Atlas of Scotland (folio edition), corresponding to an extent of surface of not less than 200 square miles, to be lodged with the Secretary on or before the 20th of October in any year.

This Map must be accompanied by a Report, giving a full description of the Geology and Mineralogy of the district represented, accompanied by coloured sections of such portions of it as may appear to require this species of illustration, founded on actual observation—if in any case the sections should be ideal, it must be so stated. In this Report, the author will be required to explain the classification and subdivision of the different rock formations he may have adopted, and, in general, to communicate every thing of interest or importance that may occur to him as being connected with the subject of the survey. He will likewise be expected to have paid particular attention to the topography of the county or district included in the survey, so as to be able to point out any errors or omissions he may have detected in the Map; or should he be able to procure a better survey of the district he is describing than that which is in the collection above referred to, he will be permitted to avail himself of it, provided it is on a scale equally suited to the purpose.

The author is further invited to direct his attention to the Soils of the district, so as to describe the ingredients of which they are composed, and whether they have been formed by the disintegration of the subjacent rocks, or have been transported from distant parts. Where the soil has been brought from a distance, the authors will state the quarters from which it appears to have been brought, as well as the boulders that occur in the soil, or are strewed over the district. It is necessary, also, that the author should shew the connection between the agriculture of the district and its rocks and soils, in reference to their influence on the pastures, crops, and timber of the district. Authors, in de-

scribing the country, must also notice any remarkable or interesting spring waters, particularly in respect to their temperature, and to the medicinal or other properties they may appear to possess. If not already sufficiently known, a chemical analysis of such waters as may be considered likely to be of importance must accompany the Report, together with specimens of the different rocks referred to in the Report, and of their mineral and organic contents—to be the property of the Society, and placed in its Museum.

Farther, for Geological Surveys deemed worthy of distinction, but which may not be found entitled to the principal premium in the year in which they are lodged, the Society's Gold or Silver Medal will be awarded to the authors. And, in order to hold out every encouragement to Geologists to assist the Society in the important object of completing Geological Surveys of the various districts of Scotland, it has been resolved, that should any survey not obtain a premium in the year in which it is transmitted, the author shall be entitled to amend it by farther observation, and to bring it forward for competition in a future year. The Surveys in competition for this premium in 1837, to be lodged on or before the 20th of October next, under the conditions on pages 5 & 6.

NOTE.—Two Hundred Square Miles being the smallest extent for which the above Premium of Fifty Sovereigns is, under any circumstances, to be awarded, will only be considered sufficient in cases in which the competitors shall have selected for the subjects of their Surveys and Reports, those districts which, from the variety or the complexity of the geological formations, and the importance of the mineral resources they contain, possess the greatest degree of public interest, and, at the same time, require the most time, labour, and talent, to describe with the minuteness and accuracy expected.

It must, therefore, be distinctly understood, that the Maps and descriptions of less interesting parts of the country in which a more uniform geological structure, and a greater sameness of mineral character, are found to prevail, will not be entitled to that premium, unless they shall comprehend such an increase in the number of square miles beyond the minimum extent above specified, as the Directors may judge to be fairly proportioned to the circumstances of the case in these respects, and to the comparative facility with which the work may consequently appear to have been performed.

2. REPORTS ON COAL DISTRICTS.

Thirty Sovereigns, or a Piece of Plate of that value, will be given for the best Geological and Mineralogical Report upon any

Coal District in Scotland, with the exception of those situated in the south-east part of the County of Fife, and the North of Lanarkshire, which have already been reported upon.

In these Reports it is expected, that besides a general description of the district, the principal shaft sections shewing the regular order of superposition and succession, as well as the thickness of the different strata, together with their lines of bearing, the direction and degree of their dip, and their organic contents, shall be carefully noticed and accurately detailed. The occurrence of faults or other disturbances, their direction, and the effects occasioned by them on the adjacent strata, must also be particularly noticed, specifying in what manner they appear to have been caused. The author must also particularly describe the trap rocks, if any exist, in the coal field, and specify their nature, situation, and extent. He will also state whether they intersect the other strata in the form of dykes, or in what other way they occur; and in each case he will describe what effect has been produced by them on the contiguous sedimentary strata. Limestone, iron, or any other profitable mineral or metallic substances in the district, must likewise be specially noticed.

Each report must be accompanied by a general map or plan of the district, and coloured sections taken through such parts of it as may best serve to illustrate the above details, and also by specimens of the most remarkable varieties of organic remains, especially of those containing vegetables, fishes, teeth, scales, bones, &c., all of which are to be the property of the Society.

The varieties of coal occurring in the district must be mentioned, as well as the price of each variety at the pit mouth. The use to which each variety of coal is generally applied, must also be noticed.

It will enhance the value of the Essays, in the opinion of the Society, if they contain a statement as to the probable quantity of coal remaining in the district unworked, together with the data on which that statement rests. It would be desirable, also, if information could be given generally as to the number of pits where coal is worked in the district, and as to the quantity of coal (stated in tons) which, during each of the preceding three years, has been raised in it, the number of steam-engines, of colliers, and horses, employed to raise the same. Authors are invited also to direct their attention to the moral and social condition of the persons employed in the collieries.

Reports of the present year's competition to be lodged on or before the 20th of October next, under the conditions on pp. 5 & 6.

No Report will be entitled to this premium unless the whole of the above conditions shall have been strictly fulfilled, and its merits will be estimated with reference to the amount and value of information given rather than to the extent of country described.

The Society's Gold or Silver Medal will be given, according to their value and extent, for such Reports on Coal Districts as may be found worthy of that distinction, but which may not be considered to be entitled to the principal premium, provided they are lodged with the Secretary by the time specified.

NOTE.—The Society takes this opportunity of pointing out to the Proprietors and Managers, and other individuals employed in Coal Works, how much they have it in their power to contribute to the advancement of science, by noticing and preserving the organic remains that have been or may be found in the coal fields with which they are respectively concerned. The fossil remains of plants, shells, crustacea, and fishes, are most commonly met with in limestone, slate-clay, bituminous shale or blacs, and in the nodules and bands of ironstone; but it is earnestly recommended that the miners should be directed to lay aside, and to preserve as entire as possible, every extraneous substance of unusual form and appearance, which they may find in any of the beds in which they are working.

The Society will at all times most thankfully receive communications on this subject, accompanied by specimens, and will confer Honorary Premiums upon those individuals who may most distinguish themselves by their intelligence, zeal, and diligence, in bringing important and interesting discoveries of this nature to its notice.

3. MINES AND MINERALS.

The Gold Medal, or a Piece of Plate of such value as the communication may be adjudged to deserve, will be given for the most satisfactory Report describing all the useful Metals or Minerals which might be profitably worked, and which are not now worked, in any particular district in Scotland; the district reported on not to be less than fifty square miles. Reports for the first competition to be lodged on or before the 20th October next, under the conditions on pages 5 & 6.

4. CONTENTS OF PEAT MOSSES.

The Honorary Gold or Silver Medal, according to the value of the communication, will be given to the person who shall transmit to the Society in any year the most satisfactory Account of the Remains, Animal, Vegetable, or Mineral, found in any Peat-Moss in Scotland, including an account of any Works of Art found, and the depth at which they were imbedded; with a description of the ex-

tent of the Moss, its depth, and general qualities, its geographical and topographical position, and height above the level of the sea. Specimens of the bones, nuts, cones, wood, leaves, adipocire, boulders, or other matters found in the moss, should, if practicable, accompany the account. At all events, the organic remains should be correctly described or figured, reference being at the same time made to the museum or collection in which they happen to be deposited. The condition, size, and kind of the timber found imbedded in the moss should be specified, and the direction in which the trees are deposited. The author will also be expected to describe the probable origin or formation of the moss, its component parts, and the subsoil on which it rests.

Essays for the first competition to be lodged on or before 20th October next, under the conditions on pages 5 & 6.

5. IMPROVEMENTS ON THRASHING MACHINES.

Twenty Sovereigns, or a Piece of Plate of that value, will be given for the best and approved Essay on the Construction of the Thrashing Machine.

The writers are required to state their opinions regarding the best moving power, whether wind, water, steam, or horses, and to give their reasons for preferring one or other of these powers in any given circumstances; and they are required to give such information as their experience enables them with regard to the application of these different moving powers.

Competitors must give such descriptions and illustrations by drawings, as may be necessary to enable the Committee to judge of the improvements or alterations proposed, and to put it in the power of machine-makers to adopt them. A detailed specification of the points to which intending Competitors are recommended to direct their attention may be had on application to the Secretary of the Society, with whom the Essays in competition for the premiums must be lodged on or before the 20th October 1837, under the conditions on pages 5 & 6.

6. FEEDING OF FARM HORSES ON RAW AND ON PREPARED FOOD.

Twenty Sovereigns, or a Piece of Plate of that value, will be given for the most detailed and satisfactory account of keeping Farm Horses on the food usually given to them, and in the usual manner, in comparison with the same or different food in a prepared state.

The Competitors are at liberty to give any kind of food, and in any proportion they please; but the exact quantity and propor-

tion given are required to be distinctly stated. The criterion by which to judge of the comparative feeding properties of the food is the working condition of the horse, in relation to the quantity and nature of the work performed. Certificates of this comparative working condition, signed by two members of the Society, must accompany the Essays. In order to preserve a uniformity in the comparative expense of feeding in the various ways, Competitors are recommended to calculate the value of the articles, and at the following prices, viz. hay 3d., straw 2d. per imperial stone of 14 lb.; oats 3s., beans 5s., barley 3s. 6d. per bushel; fine barley dust 10d. per imperial stone; potatoes 7s. 6d. per boll of 5 cwt.; salt 2s. 6d. per cwt.; coal 10s. per ton; men's wages 1s. 6d., and women's 10d. per day. Essays and certificates to be lodged with the Secretary on or before the 20th October 1837, under the conditions on pp. 5 & 6.

7. MANAGEMENT OF SHEEP WITH A VIEW TO THE IMPROVEMENT OF THE FLEECE.

Twenty Sovereigns, or a Piece of Plate of that value, will be given to the person who shall communicate to the Society the best and approved Essay, founded on experience or personal observation, on that mode of treating Sheep, whether of the Leicester, Cheviot, or Black-faced breeds, which shall ensure the greatest quantity of wool, of the finest quality; and describing those properties of Wool by which its quality may be most easily judged of.

In treating this subject, the Essayist will be required to describe in a particular manner, the treatment of Tups throughout the year,—the treatment of Ewes, from the period of tugging to that of lambing,—the treatment of Ewes and Lambs till the period of weaning,—the treatment of Ewes from the time of weaning to tugging time,—the treatment of Hogs in the autumn and during winter,—the best mode of washing Wool, whether off or on the sheep's back, and of clipping it,—the best method of rolling up and preserving the fleece for a length of time, and the best method of packing it. It is desirable that the Essayist should express his opinion of the effects of climate, situation, and food on the Wool of Sheep.

Essays to be lodged on or before the 20th October 1837, under the conditions on pages 5 & 6.

8. REARING AND FATTENING POULTRY.

To the person in Scotland who shall have reared and fed for sale the largest quantity of Poultry of the Dorking breed, between the 1st of March 1836, and the 1st of September 1837, the Silver

Medal, or a sum in Money, as the Directors may see fit in the circumstances of the case.

Competitors are required to transmit to the Secretary, on or before the 20th of October 1837, a Report detailing generally the system they may have adopted in rearing and feeding the Poultry, and their declaration that the numbers returned in claim for the premium were of the Dorking breed; a certificate by a member of the Society resident in the neighbourhood, in support of the matters detailed in the Report, must be transmitted therewith.

9. MANUFACTURE OF PAPER FROM THE FIBRE OF INDIGENOUS VEGETABLES.

The Honorary Silver Medal, or a Piece of Plate, as the Directors may see fit, will be given for an account of the best set of Experiments on the economical employment of the Fibre of Indigenous Vegetables in the Manufacture of Paper, particularly of such as may be obtained in great quantity at little cost—as pease straw, potato haulm, spent bark, &c.

Reports, with specimens of the Paper, to be lodged with the Secretary on or before the 20th of October 1837, under the conditions on pages 5 & 6.

10. THE INSECTS INJURIOUS TO VEGETATION.

Twenty Sovereigns, or a piece of Plate of that value, will be given for the best and approved Account of the Insects peculiarly injurious to the Plants usually cultivated in this country, with a scientific detail of their transformations, habits, and mode of breeding.

It is required that the Essay be the result of personal observation, that the species of Insects be correctly named and described, according to the recent entomological systems, and that the nature of the damage caused by them be explained with reference to the texture and physiology of the plant attacked; with suggestions, grounded on experiment, of the best modes of preventing or checking their ravages. Specimens, if possible, or correct drawings of the insects, in all their states, are required; and it is recommended that the observations be arranged to have reference to Cereal Plants, Green Crops, Culinary Vegetables, Fruit Shrubs, Fruit Trees, and Forest Trees.

It is, of course, expected, that diseases caused by attacks of insects be properly distinguished from those arising from bad soil, &c. rendering plants liable to be injured by insects, and that the treatment, in both cases, will be given on accurate principles.

The Essays to be lodged with the Secretary on or before the 20th October 1837, under the conditions on pages 5 & 6.

11. RESERVOIRS OF WATER FOR AGRICULTURAL PURPOSES.

The Gold Medal will be given for the best and approved Essay on the most effectual method of constructing Reservoirs of Water for Agricultural purposes, such as the impulse of mills and machinery, supplying a farm with water during summer, irrigation, or other objects.

In the Essay the various parts of the Reservoir should be minutely specified, such as,—1. Mason-work, the cements used therewith, and the sizes, shapes, and qualities of the stones. 2. The puddle, its quality, thickness, and how prepared and applied, whether in conjunction with masonry or not. 3. The gravel, cement, or other means of securing the puddle from the inroads of water, rats, and other animals. 4. The slopes of the breast-work, on both sides, and quality of materials composing it, and the mode of securing that on the water side from the operation of the waves or other casualties. 5. The mode of founding the masonry, the puddle, and the embankment, and the necessary precautions for securing them in the various strata which usually occur. 6. The best modes of carrying off the surplus water, especially when a foundation of rock cannot be obtained for the waste channel. 7. The best construction of the necessary sluices for the regulation of the supply of water to be given out of the reservoir; and, 8. Any other particulars that may be of use for securing the perfect safety of the work. It will also be desirable that the laws which regulate the pressure of water in relation to its depth, be explained in a manner as clear and familiar as possible. The quantity of rain which falls during the season, on a given surface, in places where rain-gauges have been kept, may also be stated. Essays to be lodged on or before the 20th October 1837, under the conditions on pp. 5 & 6.

12. POINTS IN CATTLE INDICATING DISPOSITION TO FATTEN EARLY.

With a view to direct attention to the comparison of points in animals that have fed kindly and attained weight early, with the same points in animals that, under similar circumstances and treatment, have not thriven so well,

The Gold Medal, or a Piece of Plate of such value as the Directors may think fit, in the circumstances of the case, will be given to the person who shall transmit to the Society the result of the greatest

number of experiments on different breeds of Neat Cattle, made with the view of ascertaining whether there be any peculiarity of anatomical structure which indicates a constitution in such cattle disposing to fatten early.

Reports, detailing every interesting particular bearing on the results, to be lodged on or before the 20th October 1837, under the conditions on pages 5 & 6.

13. POINT IN CATTLE OF THE WEST HIGHLAND BREED INDICATIVE OF DISPOSITION TO FATTEN.

It having been represented, as the result of careful observation of Cattle of the West Highland breed, that when the distance from the hough to the hoof is short, and consequently the length from the hip to the hough is relatively long, the animal having such a point is to be preferred to one that has a longer foot and shorter leg, the Society, desirous that this very prominent point should be established, supposing the observations already made to be correct, offers the following Premium:—(Should any prominent configuration of any part be ascertained to indicate a constitution disposed to fatten, the choice of stock, and the selection of calves for rearing will be greatly facilitated)

The Gold Medal, or a Piece of Plate of such value as the Directors may think adequate, will be given to the person who shall select not fewer than six Oxen of the West Highland breed, under similar circumstances, three with short, and three with long feet, and feed them nearly in the same manner; and exhibit them, after having been so fed, at the Society's General Show of Live Stock at Glasgow in 1838.

It may be observed, that many animals, as the ox, anatomically speaking, walk on their toes, hence from the hough to the hoof is properly the foot.

14. PRESERVING POTATOES.

Ten Sovereigns, or a Piece of Plate of that value, will be given for the best and approved Account, founded on experience, of the most successful method of Preserving Potatoes in good condition, in their natural state, for a period of not less than ten months from the time of their being taken up.

Competitors are required to communicate their experience as to the superiority of any of the methods now in practice, viz. securing the Potatoes in covered heaps upon the surface, in pits, in houses, vaults, cellars, or otherwise.

Very opposite opinions seem to be held on the advantages of pitting or storing in out-houses or cellars, and also as to the general temperature which should be aimed at, some recommending from 35 deg. to 40 deg., and others from 50 deg. to 60 deg. Fahr. Where pitting is preferred, there appears to be a difference of opinion as to the proper depth of the pits, and as to the thickness of the covering; likewise, whether the heap should be kept in a dry or damp state generally, and as to the utility of placing either a layer of dry straw or dry fern, or of green sprats or fresh turf, between the potatoes and the earthy covering, or of employing no other covering than the dry soil. Competitors are required to state their views on all these topics, and also as to what extent the preserving character of potatoes depends on innate qualities in the tubers, or on the mode of preservation employed; and it is desirable that the names and descriptions of the different varieties of the potato that appear better adapted than others for long keeping, should be mentioned.

Reports to be lodged with the Secretary, on or before the 20th October 1838, under the conditions on pages 5 & 6.

15. DOMESTIC DYES.

For the best and approved Essay on Domestic Dyeing, containing the receipts employed for Dyeing in various parts of Scotland and its Islands, and in which native plants form the principal ingredients—Ten Sovereigns, or a Piece of Plate of that value.

The Essay must give a description of the cloth or stuff to which each process is applicable, the colour which each receipt produces, and its durability. A particular account of the substances employed for fixing the colours, and of the mode in which they are prepared, will also be required. Small pieces of the dyed stuffs, and dried specimens of the bark and of the plants used, whether shrubby, herbaceous, or of the lichen tribe, must accompany the Essay, which must be lodged on or before the 20th October 1838, under the conditions on pages 5 & 6.

16. EFFECTS OF WOODS ON CLIMATE.

For the best Essay on the Effects of Woods on Climate, and shewing how far the climate and productiveness of a district have been or may be improved or altered by extensive plantations—A Gold Medal.

In the Essays to be given in for this premium, it is wished that the general principles advocated should, as far as possible, be supported by facts; and, in particular, it is requested that refer-

ence be made to districts formerly bare of wood, which have been extensively and judiciously planted within the last thirty or forty years, and to the effect thereby produced on the climate, as well as on the productiveness of the district. It is also desired that regard be had to the comparative advantages and disadvantages in this respect of planting in masses, stripes, clumps, and hedge-rows, and the local situations proper for each. Competitors will have in view how far the climate may have been modified or improved by other causes, such as drainage. Essays to be lodged on or before the 20th October 1838, under the conditions on pages 5 & 6.

17. SUBSOIL AND TRENCH PLOUGHING.

For the best and most approved Report on Subsoil Ploughing and Trench Ploughing—The Gold Medal, or a Piece of Plate of the same value.

The Reporter is required to state the different soils to which such modes of ploughing are respectively applicable, and, in reference to the various kinds of land, which of the subsoil and trench ploughs he most approves, the mode of operation, the depth to which the ploughs should penetrate in the respective subsoils, estimating the relative expenses of the labour, the season of the year when the work should be executed, whether thin clay or moor-lands with a retentive subsoil, are improved by deep under-ploughing without the previous expensive operation of frequent drainage, and what soils are not ameliorated by deep trench ploughing; also such further information as may suggest itself to the Reporter, carefully distinguishing, throughout his paper, practical results from theoretical opinions.

It is particularly wished that a clear distinction shall be preserved between the use of the words Trench Ploughing and Subsoil Ploughing, the former, or trench ploughing, being used where the whole soil is ploughed, and the latter, or subsoil ploughing, being used when the subsoil is stirred but not ploughed.

Reports to be lodged on or before the 20th of October 1838, under the conditions on pages 5 & 6.

18. REPORTS ON IRRIGATION.

Ten Sovereigns, or a Piece of Plate of that value, will be given for the best and approved Account of the Management of Water Meadows, founded on actual experiment, within three years preceding the date of the Essay.

The experiments to be made on not less than five acres, whether

detached or otherwise, and a description to be given of the rills or streams employed, and of the quality of the water, and of the manner of collecting and applying it; also an account of the land prior to the introduction of irrigation upon it, and of its estimated value at that period, and at the time when the Report is made; certified statements to be made of the quality of grass, if any, cut green in the spring, and the quantity and quality of the hay and aftermath produced upon the portion reported on, and the kind of stock, if any, which has been allowed to depasture it.

The Essays, accompanied by a specimen of the hay produced that season, to be lodged with the Secretary on or before 20th October 1839, under the conditions on pages 5 & 6.

19. FOREST PLANTING.

For the best and approved Essay on Forest Planting, founded on personal observation and experience, or on known practical results—A premium of Twenty Sovereigns, or a Piece of Plate of that value.

The Essay will be expected to include an account of the different soils, exposures, and declinations, best suited for growing the various kinds of Forest Trees, with remarks on the climate of different districts of Scotland, correct lists of the various genera, species, and varieties of Trees best adapted for particular situations, and the proportional number of each species which should be planted on a given space; an account of the comparative value of the different kinds of Trees, shewing the purposes for which the respective sorts are more applicable in affording wood for plough-wrights, and for general country purposes, for joists, deals, carpentry, or naval timber, &c. or useful bark; the influence of the different sorts of Trees on the pastures below them, or in their immediate vicinity; notices of the insects and diseases which affect Forest Trees, with suggestions for their prevention or cure; together with remarks on the comparative advantages of the promiscuous planting of different kinds of Trees, or of grouping masses of the same species together, both in an economical and ornamental point of view.

Essays to be lodged on or before 20th October 1839, under the conditions on pages 5 & 6.

20. SHEEP PASTURES AT HIGH ELEVATIONS.

For the most satisfactory account of the Plants constituting the Herbage on very elevated and mountainous Sheep Pastures in

Scotland, where Wedders are believed to thrive and to fatten so as to afford the finest mutton, and a similar account of the Plants constituting the old Pastures at the bases of mountains understood to be favourable for Milch Cows, and adapted for the fattening of Cattle—A Gold Medal, or a Piece of Plate of its value, in the option of the competitor.

Some of the most elevated Sheep Pastures in Scotland, from 2000 to 3000 feet above the level of the sea, are considered by many sheep farmers to afford most nutritious herbage for feeding and fattening of prime wedders; such are those on the side of Ben-vorlich, on the south-west of Strathconnan, on the high hills of Kintail, and on Benlawers in Perthshire. Various kinds of musci and lichens, and other plants, are intermixed with the alpine grasses at those heights. It is required that the botanical and common names of all the plants, phænogamous and cryptogamous, constituting the pasturage, should be given, and that their proportional abundance should be specified as nearly as can be guessed. Dried specimens of the plants will also be required, with their names attached. Botanists visiting those lofty districts may learn from the more intelligent and observing shepherds their opinions as to the nutritive qualities of the plants, or at least of particular districts of pasturage where certain plants chiefly abound; and minute inquiry should be made as to the kinds of mosses and lichens observed to be most readily or greedily cropped by the sheep. The occurrence of sea-shore plants (belonging, for example, to the genera *Statice* and *Plantago*) on these elevated stations should be adverted to, salt herbage being accounted both nutritious and fattening.

It has been remarked, that old pastures near the bases of mountains, which always contain among the gramineous plants an intermixture of various musci, afford excellent food for milch cows, the milk proving both plentiful and rich; and that such old mossy pastures are said to fatten cattle more readily than recent artificial pastures. The musci in these should be examined and compared as to their qualities with those found on the more elevated sheep walks, and specimens should also be transmitted. To be lodged on or before the 20th October 1839, under the conditions on pages 5 & 6.

21. IMPROVED SHEEP-SALVE.

A Premium of Twenty Sovereigns, or Plate of that value, will be given to the person who, on or before the 20th of October 1839, shall lodge with the Society a Specimen of a Substance which can

be economically employed for Smearing Sheep, with a view to secure the health and comfort of the animal without deteriorating the value of the fleece or carcass, and which shall have been proved by at least two successive years' use on the same stock, not under 20 scores—one-fourth of the animals upon which the experiment is repeated, being the same as those upon which it was formerly tried.

The Society understands that of late years a variety of new substances have been tried, which have either entirely or partially failed, and the wool growers, especially in the Highland districts, have been obliged to resort to the former plan of using tar and grease, believing from experience that no other known substance sufficiently protects the animal from cold and wet.

The great objection to tar is, that the value of the wool smeared with it is very much lowered from the manufacturer being unable to render it sufficiently white to dye it any bright colour. The Society is, therefore, anxious to produce a substance which will obviate this disadvantage, at the same time that the health and condition of the Stock on which it is used is completely preserved.

The Essays, with specimens of the Salve and of the Wool, and a note of the price obtained for the latter, to be lodged by 20th October 1839, under the conditions on pages 5 & 6.

22. EXTIRPATING FERNS FROM PASTURES.

Fifteen Sovereigns, or a Piece of Plate of that value, will be given for the best and approved Account, founded on experience, of a cheap mode of eradicating Ferns from Pastures, and particularly from hill pastures, where the plough cannot be employed.

The extent of ground subjected to the experiment must not be less than twenty acres; the Report must state what proportion of the surface was occupied by the ferns, with the expense per acre incurred in their eradication, and must be lodged with the Secretary, accompanied by specimens of the ferns destroyed on or before the 20th October 1840, under the conditions on pp. 5 & 6.

There is evidence in favour of the belief that the object in view may be accomplished by repeated irrigation of the ground; also, that repeated cutting of the ferns while young and succulent, thus preventing their bringing their tops to perfection during the whole season, or two consecutive years—will destroy them. It is desirable that the truth of these opinions should be established or refuted, and any other successful mode of treatment pointed out.

23. REPORTS ON DAIRY MANAGEMENT IN SCOTLAND.

To the person who shall, on or before 20th of October in any year, transmit to the Society the best Report on the Management of a Dairy, of not fewer than ten cows, in any district in Scotland—The Society's Silver Medal, or a Piece of Plate, as the Directors may see fit in the circumstances of the case.

24. REPORTS ON IMPROVED RURAL ECONOMY ABROAD.

The Honorary Gold or Silver Medal of the Society, according to the value of the communication, will be given for approved accounts, founded on personal observation, of any useful practice or practices in Rural or Domestic Economy adopted in other countries, which may seem fitted for being introduced with advantage into great Britain.

However advanced the state of the Useful Arts may be considered in this Kingdom, it is not to be doubted that there are many practices in use, both of domestic and rural economy, in other countries, and particularly in France, the Low Countries, and the North of Germany, highly deserving of attention or imitation, and which yet are too apt to be disregarded or unnoticed by the traveller or casual resident. The purpose chiefly contemplated by the offer of the present premium, is to induce gentlemen, who may visit other countries, to take notice of and record such particular practices as may seem calculated to benefit their own country in the branches of the arts referred to; and it is proposed that the earliest opportunity shall, in all cases, be taken of communicating such details to the public.

25. HONORARY PREMIUM FOR REPORTS ON CERTAIN DISTRICTS IN SCOTLAND.

To the person who shall, on or before the 20th October in any year, furnish to the Society the best Account of a District in Scotland, remarkable for any striking Improvements that have been lately effected in it, whether with reference to its Husbandry, or to the establishment of useful Manufactories, of Fisheries, or of additional facilities for external or internal communications, such as Harbours, Railroads, or other means of public conveyance, including the state and management of Public Roads, and generally of such other improvements as have a direct tendency to increase the physical resources of the district—The Society's Gold or Sil-

ver Medal, or a Piece of Plate, as the Directors may see fit in the circumstances of the case.

The Report is expected to be given from the writer's experience or observation, and the extent of the district reported upon is not to be less than fifty square miles.

In describing the present state of Husbandry, authors are required to advert to the general character of the surface in regard to its being rocky, or consisting of soil; and in describing the latter, they must state by what means it appears to have been formed, whether by disintegration of the subjacent or adjoining strata, or by transportation from other localities. The authors must also mention, and describe generally, the kind of trees which appear to thrive best within the district, and they must state whether, and what different kinds shew the most rapid and vigorous growth on the several descriptions of soil. They must also give an account of the prevailing native plants on uncultivated situations. Some account must likewise be given of the improvements made or in progress in the methods of tillage, the breeds of stock, the modes of cropping, the progress and methods of drainage, and the like.

In reference to the offer of the Premium, which is alternately made for *Manufacturing Improvements* in a district, authors must, in describing these, not only state the nature of the commodity or article manufactured, but also the nature of the machinery, and other means by which the manufactory is carried on; the number of persons of different sexes and ages employed, the value of the manufactory, the markets to which the articles manufactured are sent, the nature of the raw materials, and the source or sources whence they are respectively derived.

Authors in treating of either kind of improvements, according as their knowledge and experience may best enable them, are required particularly to state the effects which have been thereby produced, not merely in respect of the annual revenue thence accruing, but also on the moral, social, and physical condition of the inhabitants. The authors should, in their accounts, mention the elevation of the principal points of the district above the sea. They are likewise invited to offer suggestions for the future improvement of the district, whether physically or morally.

It is further expected that authors, if the district they undertake to give an account of happens to have been already described

in any well-known publication, will avoid merely repeating the information which may be found there.

CONDITIONS OF COMPETITION FOR ESSAYS AND REPORTS.

The Conditions of Competition for Essays and Reports will be found under the "Notice to Candidates" on pages 5 and 6, and to which Competitors are particularly referred.

The specimens of Mines, Quarries, &c. may be lodged at the Society's Hall at any period. The Essays and Reports on subjects 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12, are to be lodged on or before the 20th October next 1837; those on subjects 13, 14, 15, 16, and 17, by 20th October 1838; those on subjects 18, 19, 20, and 21, by 20th October 1839; on subject 22, by 20th October 1840; and Reports on subjects 23, 24, and 25, by the 20th October in any year.

CLASS III.

WASTE LANDS.

1. IMPROVEMENT OF A SPECIFIED EXTENT OF LAND BY TILLAGE.

1. To the Proprietor or Tenant in Scotland who shall, on or before the 20th October in any year, transmit to the Society a satisfactory Report of having successfully improved and brought into profitable tillage, within a period of five years immediately preceding the date of his communication, the greatest extent of waste and hitherto uncultivated Land, not being less than one hundred acres—The Gold Medal.

The Report may comprehend such general observations on the Improvement of Waste Lands as the writer's experience may have led him to make; but it is required to refer especially to the land reclaimed (which if not in one continuous tract, must be in fields of considerable extent), to the nature of the soil, the previous state and probable value of the ground, the obstacles opposed to its improvement, the mode of management adopted, the expense, and, in so far as can be ascertained, the produce and value of the subsequent crops; and the land must have borne one crop of grain, at least, previous to the year in which the report is made. The report must be accompanied by a detailed statement of the expense, and by a certified measurement of the ground. Competitors will also attend to the usual General Conditions on pages 5 and 6.

2. To the Tenant in Scotland who shall, on or before the 20th October in any year, transmit to the Society a satisfactory Report of having, within the period of three years preceding the date of his

Report, successfully improved, and brought into profitable tillage, an extent of waste and hitherto uncultivated Land, not being less than thirty acres, on the same farm.—The Honorary Silver Medal.

Honorary Premiums for the more limited extent are offered under the same conditions as the Premium for No. 1., and Reports detailing the particulars above specified, accompanied by a certified measurement of the ground, to be transmitted to the Society before the 20th October in any year. Competitors are referred to General Conditions, pp. 5 and 6, and they will observe, that, having gained the Silver Medal, it shall not afterwards be competent to include the same improvement in a subsequent claim for the Gold Medal.

2. IMPROVEMENT OF A SPECIFIED EXTENT OF LAND FOR PASTURE.

1. To the Proprietor or Tenant in Scotland who shall, on or before the 20th October in any year, transmit to the Society the most satisfactory Report of having, within the period of five years immediately preceding the date of his communication, successfully improved an extent of waste and hitherto uncultivated Land, not being less than one hundred acres, by draining, accompanied with irrigation or top-dressing with lime or other substances, or paring and burning the surface, and sowing grass seeds with or without a green crop—The Gold Medal.

The Reports are required to advert to all the particulars specified in the Conditions in the Premiums for the improvement by tillage, so far as these are applicable to the improvement of land for pasture; and the land must have been hayed or pastured three years at least previous to the year in which the Report is made. The Reports must be accompanied by a detailed statement of the expense, and by a certified measurement of the ground. Competitors will also attend to the usual General Conditions on pages 5 and 6.

2. To the Tenant in Scotland who shall, on or before the 20th October in any year, transmit to the Society a satisfactory Report of having, within the period of three years preceding the date of his Report, successfully improved for pasture an extent, not being less than thirty acres on the same farm, of waste and hitherto uncultivated land, in the manner indicated in reference to the immediately preceding Premium—The Honorary Silver Medal.

Honorary Premiums for the more limited extent are offered under the same conditions as the premium for upwards of one hundred

acres; but competitors will observe, that, having gained the Silver Medal, it shall not afterwards be competent to include the same improvement in a subsequent claim for the Gold Medal.

Reports detailing the particulars required, and accompanied by a certified measurement of the ground, to be transmitted to the Society before the 20th of October in any year, under the usual conditions on pages 5 and 6.

3. RECLAIMING LAND FROM THE SEA.

To the Proprietor or Tenant in Scotland who shall, on or before the 20th of October in any year, transmit to the Society a satisfactory Report of his having, within the period of five years immediately preceding the date of such report, reclaimed from the sea an extent of not less than five acres of land, or having converted into pasture an extent of not less than five acres of barren ground, periodically overflowed by the sea. The expense and mode of improvement to be accurately detailed, and the returns such as to hold out a reasonable prospect of remuneration—The Honorary Silver Medal, or a Piece of Plate, as in the opinion of the Directors the improvement may be held to deserve. Competitors will attend to the General Conditions on pages 5 and 6.

4. RECLAIMING LAND BY EMBANKING RIVERS.

For the most satisfactory Report of the embankment of a river in Scotland, causing a profitable addition to or amelioration of the neighbouring lands, in consequence of securing them from the effects of inundations to which they had been previously subject—The Silver Medal, or a Piece of Plate of such value as the communication may be adjudged to deserve. Competitors will particularly attend to noticing any effectual means which may have been adopted for preventing the inroads of moles or other vermin, into the embankment.

Reports to be lodged by the 20th of October in any year, under the General Conditions on pages 5 and 6.

CLASS IV.

CROPS AND CULTURE.

1. NEW PLANTS ADAPTED TO FIELD CULTURE.

To the Person who shall, on or before the 20th October in any year, report to the Society any new species or variety of useful

Plant, adapted to the ordinary field culture of Scotland—The Silver Medal, or a Piece of Plate, as the Directors may see fit in the circumstances of the case.

Satisfactory evidence will be required that the plant produced is new in the cultivation of the country, either as regards the species or variety, valuable as regards the uses to which it may be applied, and congenial to the soil and climate of Scotland. A particular detail of the discovery or circumstances which led to the experiment must be furnished, the mode of culture described, and a specimen of the plant transmitted; with such suggestions as to the probable value of its straw as experience may have enabled the competitor to afford.

2. EARLY ANGUS OATS OF THE GREATEST WEIGHT.

The District of Strathspey, comprehending the Parishes of Cromdale and Inverallan, Abernethy, Kincardine, and Duthill, in the Counties of Moray and Inverness.

To the Tenant in the above district who shall raise the heaviest early Angus Oats, not weighing less than 40 lb. per imperial bushel, upon any farm within the district, crop 1837—Seven Sovereigns.

To the Tenant who shall raise the second heaviest early Angus Oats in the said district as aforesaid—Three Sovereigns.

To the Tenant who shall raise the third heaviest early Angus Oats in said district as aforesaid—Two Sovereigns.

The quantity raised by each competitor not to be less than fifteen imperial quarters, to be weighed between the 20th November 1837 and 20th March 1838; the weight to be the imperial standard. The sample to be exhibited at the place of competition must not be under five quarters, and satisfactory evidence must be produced that it is a fair specimen. The measure and weight of the sample are also to be ascertained in the presence of, and certified by, a Member of the Society or a Justice of the Peace, whose certificate shall be accompanied by the declaration of the persons who had weighed the whole quantity for which the party competes. If the weight shall in any case be equal, the tenant who has the largest quantity to receive the premium. The certificates and declarations, with samples of the oats, not under half-a-pound, to be lodged at the Society's Hall on or before the 1st May 1838.

3. PLOUGHING COMPETITIONS.

Premiums to Ploughmen for improvement in ploughing having

for some years been given very generally over the country by the resident gentlemen and local Farming Societies, the Highland and Agricultural Society has, in the mean time, discontinued them; but being desirous of encouraging improvement in this branch of husbandry, the Society will give its Silver Plough Medal to the Ploughman found to be the best at such competitions, provided not fewer than fifteen ploughs shall have started, and that premiums in money to an amount not less than three sovereigns shall have been awarded. The Medal will be issued upon a Report from one or more Members of the Society, who shall have actually attended the competition, stating the number of ploughs that had started, the number and amount of the money premiums awarded, and that the ploughman found to be the best had not received the Society's Medal at a previous competition in the same district.²

The Report must be lodged with the Secretary, at the Society's Hall, within three months after the competition, otherwise the Medal will not be issued.

CLASS V.

PASTURES.

1. MANAGEMENT OF PASTURE LANDS.

The Gold Medal, or a Piece of Plate of the same value, will be given to the Proprietor or Tenant in Scotland who shall, on or before the 10th of November in any year, report to the Society the most successful Management of Pasture Lands, founded on practice.

The land, forming the subject of the Report, must have been pastured for at least three seasons, exclusive of that in which the Report is given in, and the extent of ground must not be under ten acres. If the land has been sown down within a period of eight years previous to that in which the Report is made, the reporter will be required, besides stating the mode adopted in laying down, and the kinds and quantities of seeds used, to give a correct detail of the management from the period of sowing until the land be sufficiently consolidated for the purpose of being depastured. In any case, the reporter will be required to state the kind and quality of the soil, with its exposure and elevation, the mode of drainage, and the various proportions of grasses and other plants constituting the pasture; the means

which have been employed in maintaining or increasing the productiveness of the herbage by top-dressing or otherwise; the description of stock grazed; and the modes which have been found most successful in practice of preventing or destroying the growth of the musci, and other plants injurious to the pasture. Competitors are referred to the General Conditions on pages 5 and 6.

CLASS VI.

LIVE-STOCK.—DISTRICT COMPETITIONS.

§ I. CATTLE.

PREMIUMS FOR IMPROVING THE BREED OF CATTLE IN THE FOLLOWING DISTRICTS :—

1. *The Districts of Eskdale and Liddesdale, in the counties of Dumfries and Roxburgh.*
2. *The Islands of North and South Uist, Harris, Barra, and small Isles adjacent, in Inverness-shire.*
3. *The Districts of Breadalbane, Glenorchy, Glenlyon, Glenochy, Glendochart, Glenfalloch, and Rannoch, comprehending the parishes of Kenmore, Killin, Glenorchy, Fortingall, Dull, Weem, and Logierait, in the counties of Perth and Argyll.*
4. *The District of Garioch, Aberdeenshire.*
5. *The Parishes of Glenisla, Lintrathan, Kirriemuir, Lochlee, Edzel, Lethnot, Cortachy, Clova, Airlie, Glammis, Forfar, Tannadice, Fearn, Ruthven, Kingoldrum, and Menmuir, in the county of Forfar.*
6. *The District of Formartin, in Aberdeenshire.*
7. *The Islands of Islay, Jura, and Colonsay, in the county of Argyll.*
8. *The District of Argyll, and the parishes of North and South Knapdale, and the parish of Kilberry, north of the Isthmus of Tarbert, Argyllshire.*
9. *The Braemar District of Aberdeenshire, comprehending the parishes of Braemar, Crathie, Tullich, Glenmuick, and Glen-gairn, but excepting that part of Tullich situated in Cromar.*
10. *The Eastern District of Fifeshire, comprehending the parishes of Kilconquhar, Elie, St Monance, Pittenweem, Carnbee, East Anstruther, West Anstruther, Kilrenny, Craill, Kingsbarns, St*

Andrew's, Denino, Cameron, Leuchars, Newburn, Largo, Leven, Scoonie, Forgan, and Ferry-port-on-Craig.

11. *The Parishes of Inveravon, Kirkmichael, Mortlach, and Aberlour, in Banffshire, and Cabrach and Knockando, in Aberdeen and Moray shires.*
12. *The Counties of Moray and Nairn.*
13. *The District of Turriff, in the Counties of Aberdeen, and Banff.*
14. *The County of Linlithgow.*

For the best Bull, from two to seven years old, *bona fide* the property, and in possession, of any Proprietor or Tenant in *each* of the eight districts, Nos. 1, 4, 5, 6, 10, 12, 13, and 14, as above described, kept on his farm, within the District, from the 20th day of May preceding the day of Competition—Ten Sovereigns.

For the second best Bull, of the age above specified, *bona fide* the property, and in possession, of any Proprietor or Tenant in *each* of the said eight Districts, and kept on his farm, within the District, for the aforesaid period—Five Sovereigns.

For the best two Queys, of two years old, the property of, and bred by, any Tenant in *each* of the said eight Districts, Nos. 1, 4, 5, 6, 10, 12, 13, and 14—Five Sovereigns.

For the second best two Queys, of two years old, the property of, and bred by, any Tenant in *each* of the said eight districts—Three Sovereigns.

For the best Bull, exhibited at the Competition in *each* of the six Districts, Nos. 2, 3, 7, 8, 9, and 11, being of the age above specified, and *bona fide* the property of a Proprietor, Factor, or Tenant, kept in his possession for the foresaid period—The Honorary Silver Medal.

For the best Bull, from two to seven years old, *bona fide* the property, and in possession, of any Tenant in *each* of the said six Districts, Nos. 2, 3, 7, 8, 9, and 11, kept on his farm within the District, from the 20th day of May preceding the Competition—Ten Sovereigns.

For the second best Bull, of the same age, in *each* of the said six last mentioned Districts, the property, and in possession, of any Tenant, and kept on his farm within the District for the foressaid period—Five Sovereigns.

For the best two Queys, of three years old, the property of, and bred by, any Tenant in *each* of the said six Districts, Nos. 2, 3, 7, 8, 9, and 11, above described—Five Sovereigns.

For the second best two Queys, of three years old, the property of, and bred by any Tenant in each of the said six Districts—Three Sovereigns.

The Competition in the Districts Nos. 1 to 6, both inclusive, will take place in 1837, and in Nos. 7, 8, 9, 10, 11, 12, 13, and 14, in 1838.

The following Members of the Society (as Members only, or their Factors, in their absence, can be named) are hereby appointed Committees for regulating all details at the Competition for the six Districts first above mentioned. In the Districts Nos. 7, 8, 9, 10, and 11, the Committees were named in the advertisement of 1836, and the Committees for the Districts Nos. 12, 13, and 14, will be intimated in that of 1838.

FOR THE FIRST DISTRICT—The Duke of Buccleuch—Lord John Scott, M. P.—the Right Hon. Sir James Graham, Bart. M. P.—J. J. Hope Johnstone, Esq. M. P.—William Blamire, Esq. formerly M. P. for Cumberland—W. H. Borthwick, Esq. of Hopesrig—G. Scott Elliot, Esq. of Larriston—George Bell, Esq. Woodhouselees—A. H. Maxwell, Esq. of Portrack—W. Oliver Rutherford, Esq. of Edgerston—Major Oliver of Bush—Thomas Stavert, Esq. of Hosecoat—and any other Members in the District; three a quorum.—The Duke of Buccleuch, in his absence Mr Scott Elliot, to be Convener.

FOR THE SECOND DISTRICT—Lord Macdonald—R. G. Macdonald, Esq. of Clanranald—R. Macneill, Esq. of Barra—R. Macdonald, Esq. of Bornish—Duncan Shaw, Esq. Factor to Lord Macdonald—Charles Shaw, Esq. Lochmaddy—Mr Stewart, Harris—and any other Members in the District; two a Quorum.—Lord Macdonald, in his absence Mr Duncan Shaw, to be Convener.

FOR THE THIRD DISTRICT—The Marquis of Breadalbane—Sir Neil Menzies, Bart.—Sir John Stewart, Bart.—Archibald Butter, Esq. of Fascally—J. L. Campbell, Esq. of Glenfalloch—Archibald Campbell, Esq. Factor on the estate of Menzies—Colonel J. Macdonald of Dalchoisnie—James Menzies, Esq. of Pitnacree—John Menzies, Esq. of Chesthill—Major Archibald Menzies, late 42d Regiment—Robert Menzies, Esq. W. S. Mr Cumming Menzies of Knockintober—Alexander Stewart, Esq. of Derculich—Joseph Stewart Menzies, Esq. of Foss—William Stewart, Esq. of Ardvorlich—Robert Stewart, Esq. younger of ditto—James Stewart Robertson, Esq. of Edrady-nate—Robert Robertson, Esq. of Auchleeks—Captain Robertson of Kindrochit—Mr Stewart, Chesthill—and any other Mem-

bers in the District; five a quorum.—The Marquis of Breadalbane, in his absence Sir Neil Menzies, to be Convener.

FOR THE FOURTH DISTRICT—The Earl of Kintore—Sir R. D. Horn Elphinstone, Bart.—Lieutenant-General Sir A. Leith of Freefield—John Burnet, Esq. of Kemnay—Colonel W. H. Knight Erskine of Pittodrie—Colonel Fraser of Castle Fraser—David John Gordon, Esq. of Wardhouse—James Gordon, Esq. of Manar—John Gordon, Esq. of Newton—Robert Grant, Esq. of Tillyfour—General Hay of Rannes—Colonel Sir Andrew Leith Hay, M. P.—Patrick Irvine, Esq. of Inveramsay—George Leslie, Esq. of Rothie—William Leslie, Esq. of Warthill—H. Leith Lumsden, Esq. of Auchindoir—Hugh Lumsden, Esq. of Pitcaple—R. Mackenzie, Esq. of Glack—J. Mackenzie, Esq. younger of do.—B. C. Urquhart, Esq. of Meldrum—Mr Walker, Suttie,—and any other Members in the District; five a quorum.—Sir R. D. H. Elphinstone, in his absence Mr Lumsden of Pitcaple, to be Convener.

FOR THE FIFTH DISTRICT—The Earl of Airlie—Lord Panmure—Colonel the Hon. D. Ogilvy of Clova—the Hon. W. Ogilvie, Airlie Castle—Lieutenant-Colonel Chalmers of Gleniericht—P. Watson Carnegie of Lower and Turin—Alexander Crookshanks, Esq. of Keithock—Mr Carnaby, Forfar—Mr Dalgairus, Ingliston—Thomas Farquharson, Esq. of Baldovie—Thomas Gardyne, Esq. of Middleton—John Guthrie, Esq. of Guthrie—John Guthrie, Esq. younger of Guthrie—Charles Hay, Esq. of Ballindoch—George Kinloch, Esq. of Kinloch—George Lyon, Esq. of Glenogil—Mr Macnicol, Factor to Lord Airlie—John Ogilvie, Esq. of Inchewan—P. Wedderburn Ogilvy, Esq. of Ruthven—W. D. Proctor, Esq. of Halkerton—Thomas Rattray, Esq. younger of Brewlands—Major James Wilkie of Newbarns—and any other Members in the District; five a quorum.—The Earl of Airlie, in his absence the Hon. W. Ogilvie, to be convener.

FOR THE SIXTH DISTRICT—The Earl of Aberdeen—the Hon. Captain William Gordon, M. P.—Sir Michael Bruce of Scots-toun—Sir William Seton of Pitmedden, and Sir R. D. Horne Elphinstone of Logie Elphinstone, Baronets—William Gordon, Esq. of Fyvie—B. C. Urquhart, Esq. of Meldrum—and any other Members in the District; three a quorum.—Captain the Hon. William Gordon, M. P., in his absence Mr Urquhart of Meldrum, to be Convener.

FOR THE SEVENTH, EIGHTH, NINTH, TENTH, AND ELEVENTH DISTRICTS—The Committees remain as last year, with the addition of those resident Members since elected.

FOR THE TWELFTH DISTRICT—Sir Archibald Dunbar, Bart. and Robert Grant, Esq. of Kincorth, Conveners.

FOR THE THIRTEENTH DISTRICT—The Earl of Fife, in his absence James Grant Duff, Esq. of Eden, Convener.

FOR THE FOURTEENTH DISTRICT—The Earl of Rosebery, in his absence J. M. Hog, Esq. of Newliston, Convener.

RULES OF COMPETITION.

1. The Conveners, with the approbation of a quorum of the Committee for conducting the several Competitions, are respectively authorized, in such cases as they shall see proper, to divide the two Premiums allowed for Bulls into three Premiums, in such proportions as they shall approve; the first Premium for Bulls not being less than Eight Sovereigns; and, in like manner, to divide the sums allowed for Queys into three Premiums, fixing their amount.

2. The Committee shall not place for Competition any stock which, in their opinion, does not fall within the regulations prescribed, or does not possess merit; and in no instance shall any of the Money Premiums be awarded, where there are not, after such selection, at least three Competitors, reserving to the Committee, in the case here provided for, to make such allowance to a party shewing stock of merit, not exceeding half the amount of the Premium, as, under the circumstances, they may think reasonable.

3. The times, and also the places of Competition, are to be fixed by the Convener, with the advice of at least a quorum of their respective Committees, except in the second and twelfth districts, as to which, Benbecula is named as the place of Competition for the former, and in the latter Elgin and Forres alternately, commencing with Elgin. The Competitions for the Society's and for the District Premiums are to take place between the 1st of June and the 1st day of November next.

4. The Convener of each Committee will give timely notice to the other Members of the Committee of the place and time of the Competition, and will be particularly careful that the same be intimated at the several parish-church doors within the District, for at least two successive Sundays previous to the Competition.

5. As these Premiums were given, in some of the above-mentioned Districts, in 1834, 1835, and also in 1836, it is to be observed that the Society does not admit an animal, in any class of stock, which may have gained the Society's first Premium at a District or General Show in a former year, to be again shewn in Competition in any District; and for no description of stock shall either the same or a lower denomination of Premium be awarded, in the District in which they have already gained a Premium. In those Districts where the Honorary Silver Medal is offered for Bulls, Tenants cannot compete with the same animal, both for the Honorary and the Money Premiums.

6. No Member of the Committee, shewing Stock of his own at the Competition, shall act as judge; nor shall Factors, when they are Members of the Society, and are named on the Committee, or when acting in the absence of Proprietors, be entitled to compete for the Money Premiums in those Districts and Classes in which Proprietors are excluded from Competition. It is recommended to the Committee to take the assistance of practical men as judges in awarding the Premiums. In all cases, the Bulls for which the Money Premiums are awarded, must have served, or shall be kept to serve, the District, for at least one season, at a moderate charge for each Cow, and the rate may be fixed by the Committee.

The same person is not to obtain more than one of the Premiums for Bulls, nor more than one of the Premiums for Queys, in one year, except in those Districts where Tenants compete for the Honorary and Money Premiums for Bulls, in which case they may, with different animals, carry the Medal and one of the Money Premiums. While the Directors have deemed it expedient to exclude Proprietors and Factors named on the Committee, or acting in the absence of Proprietors, from competing for the *Money Premiums* in certain Districts where it is apprehended that the superiority of their stock might discourage Competition on the part of the Tenantry, they are fully impressed with the advantages of having such stock exhibited at the District Shows, and have offered the Honorary Silver Medal of the Society for the best Bull exhibited at the Competition, should he be the property of one in that class, and superior to the Bull to which the highest Money Premium is awarded. A Bull which, as the property of a Proprietor, may have gained the Honorary Medal, will be allowed to compete in a future year for the highest Money Premium, when *bona fide* the property, and in the possession of a Tenant, provided it should have continued the Proprietor's property for at least one year after the award of the Medal, and shall have afterwards been the Tenant's property, and in his possession from the day fixed by the regulations (20th May). A Bull which may have been purchased by two or more Tenants for the use of their stocks, will be allowed to compete, although the exhibitors are not joint tenants.

7. In order to entitle the Competitors to their respective premiums, a regular Report, signed by the Convener, and at least a majority of the Committee who attend the Competition, must be transmitted by the Conveners, so as to be received by the Secretary on or before the 10th of December next, and which Report must specify the ages of the Bulls and Queys preferred; the length of time the Bulls have been in the possession of the Competitors, and, with respect to the Queys, that they were bred by the Competitors, and were their property on the day of competition; the number of Bulls and Queys respectively produced thereat; the number placed for competition in each class; the names and designations of the persons to whom the Premiums have been adjudged; amount of Premiums voted to each; and, in general, that all the rules of Competition fixed by the Society, as above mentioned, have been strictly observed; and, in particular, that the previous intimations to the Committee of Judges, and advertisements at the church doors, were regularly made as required. In case all the Members of the Committee who may have attended shall not have subscribed the Report, the Convener will mention the cause which may have prevented their doing so.

Further, it is to be distinctly understood, that in no instance does any claim lie against the Society for expenses attending a Show of stock, beyond the amount of the Premiums offered.

With reference to the competitions in the 2d, 3d, 7th, 8th, and 11th Districts, the Reports must bear that the Bulls and Queys preferred were of the West Highland breed; in the 10th, of the Fifeshire breed; and in the 4th, 6th, 12th, and 13th, of the Aberdeenshire breed, the 4th being limited to the Polled Aberdeenshire. A certain portion of the Premiums in the 14th District is authorized to be assigned to Stock of the Short-Horn breed, and a portion to the Ayrshire breed.

Conveners are requested to get the Reports drawn up and signed by a majority of the Committee present at the Competition, before they separate.

NOTE.—The Society, impressed with the benefit to be derived from continuing these Competitions in the same Districts for a longer period than was formerly the practice, gives the Premiums for three Competitions in alternate years; and provided the Gentlemen of the District, or any Local

Association therein, shall have continued the Competitions, and have awarded Premiums in the district to an amount not less than one-half the Society's Premiums, and for the same description of stock, during the two intermediate years, the Society continues its Premiums to the District for an additional year. By this arrangement each District may have the benefit of six Competitions. In Districts Nos. 1, 2, 3, 4, and 5, 1835 was the first year's Competition; Local Premiums were awarded in 1836 in Districts 2, 3, and 4, and this year these five districts have the Society's Premiums, which will be again given in the same districts in 1839, and also in 1840 in those Districts which shall have awarded local Premiums, as before mentioned, in the years 1836 and 1838. In the District No. 6, this is the first year's Competition for the Society's Premiums; it will be entitled to the Society's Premiums in 1839 and 1841, and also in 1842 if it awards Local Premiums in 1838 and 1840. In Districts Nos. 7, 8, and 9, 1834 was the first Competition; they had the Society's Premiums in 1836, and will again have them in 1838, and also in 1839, if they shall have awarded Premiums in the intermediate years. In Districts 10 and 11, 1836 was the first Competition, and they will again have the Society's Premiums in 1838 and 1840. If they award Premiums in the intermediate years, they will have the Society's Premiums for the additional year in 1841. The Districts Nos. 12, 13, and 14, are now offered for 1838, as the first year's Competition, and the Premiums will be continued in 1840 and 1842; and if the Districts give Premiums in 1839 and 1841, the Society's Premiums will be again given in 1843. Farther, in order to encourage the Show for the Local Premiums, the Society, in those Districts in which the Honorary Silver Medal is given, will continue it in the two intermediate years, under the same conditions as during the years when the Society's Premiums are given. A certificate of the Competition and Premiums awarded at the intermediate Local Shows in the several districts, signed by at least two Members of the Society, must be transmitted to the Secretary of the Society, so as to be received by him on or before the 10th December in each year, in order to entitle the Districts to any claim for the additional year's Premiums.

§ II. WORK HORSES.

PREMIUMS FOR IMPROVING THE BREED OF DRAUGHT HORSES.

1. *The Counties of Ross and Cromarty.*
2. *West Tiviotdale,— Roxburghshire.*
3. *The Upper and Middle Wards of Lanarkshire.*

In each of the above districts Twenty-five Sovereigns will be given by the Society, a Sum not less than Twenty Sovereigns additional being given by the resident gentlemen, or by Local Societies, for the improvement of the breed of Draught Horses. The premiums to be as follows:—

For the best Stallion, not under three years and nine months, and not exceeding twelve years old, kept exclusively for the improvement of the breed of Draught Horses, within each of the said districts Nos. 1 and 2, and for this purpose to be shewn after the premiums have been awarded at such stations as may be fixed by the

Conveners and Committee of members of the Society resident in the respective counties, for service by each of the Prize Stallions of not more than seventy Mares, at a rate not exceeding one Sovereign for each, at such times between the 1st April and the 1st August 1837, as the respective Committees may fix, at a meeting to be called by the Conveners for the purpose—Twenty-five Sovereigns.

For the best Mare for breeding Draught Horses, not exceeding twelve years old, and which shall have had at least one foal, *bona fide* the property and in possession of any tenant in each of the said two districts, from 1st January 1836 to the day of competition—Ten Sovereigns.

For the best Entire Colt, not exceeding forty-five months old, *bona fide* the property of any proprietor or tenant in each of the said two districts—Ten Sovereigns.

NOTE.—The premium to the best Stallion must be awarded under the condition, that the Prize Mare, and the Mare which shall be declared by the judges next in merit, shall have a preference of service by the Prize Stallion, free of charge; all the competing Mares to have a preference over other Mares to service by the Prize Stallion, on such terms and conditions as the local Committees shall fix, but the charge in no case to exceed the sum indicated by the terms of the Premium. Evidence must be produced that the Prize Stallions have had produce.

RULES OF COMPETITION.

The time and place of competition for the Premiums are to be fixed by the Conveners, with the concurrence of at least a quorum of the respective Committees, and are to be published by the Convener, at the church doors, in due time, or in such other manner as shall be thought by him and a quorum of the Committee effectual for the information of those interested.

The competition will take place in the first and second Districts betwixt 20th March and 1st May 1837, and in the third District within the same period in 1838. The regulations for cattle shows, in regard to fixing the competitions,—the previous intimation to the Committee and competitors,—the recommendation to the Committee to take assistance of practical men as judges,—the power of the Committee to withhold the Premiums, if the animals produced shall be of inferior character,—those relating to extra expenses, and against competitors being also judges,—and the manner in which the Reports are to be certified and transmitted to the Society, are severally hereby declared applicable to the premiums for horses.

The premiums now intimated are for the first competition in the three Districts. The expediency of continuing the premiums for another year, is open for consideration, provided the Districts shall respectively propose again to guarantee a sum equal to what they now contribute.

The Members of the Society in the respective districts are appointed Committees for regulating every thing relative to the competitions, with power to name Sub-Committees of their number for attending to the necessary details.

FOR THE FIRST DISTRICT.—Sir Colin Mackenzie, of Kileoy, Bart. Con-

vener of the County of Ross, and Roderick Macleod, Esq. of Cadboll, M.P., or either of them, to be Conveners of the resident Members ; five a quorum.

FOR THE SECOND DISTRICT.—His Grace the Duke of Buccleuch, in his absence Allan Elliot Lockhart, Esq. of Cleghorn, to be Convener of the resident Members ; three a quorum.

The Convener and Committee for the Third District will be named in the advertisement for 1838.

§ III. SHEEP AND WOOL.

PREMIUMS FOR IMPROVING THE BREED OF SHEEP IN THE FOLLOWING DISTRICTS.

1. *The Districts of Morven, Ardnamurchan, and Kingierloch, Argyleshire.*
2. *The following District in Inverness-shire, viz. from the Ferry of Balachulish on the west, to the march of Letterfinlay, with Glengarry on the east, including both sides of Loch Lochy, both sides of Loch Arkeg, Lochiel until it reaches Glenfinnan, the whole of Glenspean and Glenroy, so far as the Badenoch march on both sides, and also including the District of Ardgour in Argyllshire.*
3. *The Districts of Badenoch and Rothiemurchus in Inverness-shire.*

For the best six Tups of the black-faced breed, not exceeding four years old, the property of any proprietor or tenant in the said first District, which shall be certified at the Competition to belong to a flock of not less than 120 Ewes, and to have been no otherwise grazed or fed during the last season than the exhibitor's Tups of the same age, and to have served the Ewes of the flock in the same manner, and at least for one month of the season—Six Sovereigns.

For the second best Six ditto—Four Sovereigns.

For the best Pen of eighteen Gimmers or Ewes of the black-faced breed, from sixteen to twenty months old, the property of any proprietor or tenant within the said first District, and which shall be certified at the Competition to have been at least one year in his possession, and to have been, during that year, grazed on the same kind of pasture with the remainder of the flock of the like age—Six Sovereigns.

For the second best Pen as aforesaid—Four Sovereigns.

The Competitions for the Districts Nos. 2 and 3, takes place in 1838, also for Sheep of the black-faced breed.

The following Members of the Society are appointed a Committee for awarding the premiums in the First District.

FOR THE FIRST DISTRICT.—Sir James Milles Riddell, Bart.; Charles Henry Forbes, Esq. of Kingerloch; John Gregorson, Esq. of Ard-tornish; Charles Gordon, Esq. of Drimnin; Dr Maclaine of Kilmundin; Colin Maclachlan, Esq. Laudle; Eun Maclachlan, Esq. Liddesdale; John Sinclair, Esq. of Lochaline; and any other Members in the District, three a quorum,—Sir James Milles Riddell, Bart., in his absence, Mr Gregorson, to be Convener.

The Committee for the 2d and 3d Districts were named in the advertisement of last year.

RULES OF COMPETITION.

The competition for the Premiums in the first district will take place at Keil, at such time between the 1st of June and 1st of November 1837, as shall be fixed by the Conveners, with the advice of a quorum of the Committee. It is recommended to the Committee, as in the case of cattle competitions, to take the assistance of practical men as Judges in awarding the Premiums. The Judges in deciding the Premiums for Sheep, will have regard both to the wool and carcass of the animal. The regulations for Cattle Shows, in regard to the previous intimations to Judges and Competitors,—the placing of the stock, and the number of Competitors required for competition,—the power to make provisionally an allowance for Stock of merit in the event of deficiency in number, and prohibiting Members acting as Judges who are also Competitors,—the regulations relating to Extra-expenses,—and the manner in which the Reports are to be certified and transmitted, are severally hereby declared to be applicable to the Premiums for Sheep. The Second Competition in the First District will be held at Strontian. In the other two Districts the Committees are respectively empowered to fix the place of competition.

The NOTE annexed to the rules of competition for the Premiums for Cattle, is also applicable to the Districts for Sheep, in which the Premiums will be continued by the Society for an additional period, on the conditions specified in the said Note. In the First District, the present is the first year's competition for the Society's Premiums, which will be again given in the years 1839 and 1841; and if the District shall award Local Premiums in the intermediate years 1838 and 1840, the Society's Premiums will be given for the additional year in 1842. In the Second District 1838 will be the third year's competition for the Society's Premiums, and if it this year awards Local Premiums, the Society's Premiums for the additional year will be given in 1839. In the Third District, 1836 was the first competition for the Society's Premiums, which will be again given in 1838 and 1840; and if the District gives Premiums in 1837 and 1839, the Society will again give the Premiums in 1841 for the additional year.

§ IV. SWINE.

PREMIUMS FOR IMPROVING THE BREED OF SWINE.

1. *Kintyre Argyllshire.*
2. *The County of Inverness.*

For the best Boar, not under twelve months, and not exceeding

four years old, *bona fide* the property and in possession of any proprietor or tenant in the first District, in autumn 1837—Seven Sovereigns.

For the second best—Three Sovereigns.

For the best Breeding Sow of the same age—Four Sovereigns.

For the second best—Two Sovereigns.

These premiums to be awarded for animals that are considered most profitable, and best suited for the purpose of curing mess pork. Attention is recommended to the introduction of the Berkshire or Suffolk breed of Swine, as being the best for curing pork.

The Competitions are to be held at such times as the Society's Members resident in the districts shall fix, at a meeting to be intimated by the respective Conveners for the purpose. This meeting is also authorized to name a Committee for managing all details, and to fix the necessary regulations for competition.

A Report of the award of the Premiums, with a copy of the Regulations of Competition, to be transmitted to the Secretary on or before the 10th of December 1837, for the First District, and by the same date in 1838, for the Second District. Campbelltown is fixed as the place of Competition for the First, and Inverness for the Second District.

FOR THE FIRST DISTRICT.—Richard Campbell, Esq. of Anchnabreck; in his absence, J. L. Stewart, Esq. of Glenbuckie, to be Convenir.

FOR THE SECOND DISTRICT.—John Stewart, Esq. of Belladrum, and William Macintosh, Esq. of Geddes; in their absence, J. Mackenzie, Esq. banker, Inverness, to be Conveners.

The Premiums were given in the First District in 1835. Their continuance in 1837 was made dependent on the award of the same description of Premiums in the year 1836, by the Gentlemen of the district, or any local association therein.

CLASS VII.

PRODUCTS OF LIVE STOCK.

§ I. CURING BUTTER.

DISTRICTS.

1. *The County of Caithness.*
2. *The County of Orkney and Zetland.*
3. *The District of [Perthshire, comprehending the Parishes of Dunblane, Kilnadock, Port of Monteith, Aberfayle, and Kincardine.*

The Premiums given, and regulations suggested, for promoting

an improved system of Curing Butter, having been productive of highly satisfactory results, the following Premiums are offered in the first and second Districts in 1837.

To the owner of any Dairy in the said first and second districts who shall make and cure the best quality of Butter for the market, not being less than two cwt. (112 lb. to the cwt. or 16 oz. to the lb.) during the season 1837—Six Sovereigns.

For the second best quality, as aforesaid—Four Sovereigns.

For the third best quality, as aforesaid—Three Sovereigns.

For the fourth best quality, as aforesaid—Two Sovereigns.

Similar Premiums to be given in the third district in 1838, as the second year's competition.

CONDITIONS.

The Butter in the First and Second Districts must be certified to have been made and cured on the competitor's farm during the season 1837; and the certificate must be supported by the declaration of the exhibitor, which must further bear, that the sample produced is a fair average of the quantity made and cured as aforesaid. It shall be inspected by a Committee of the Members of the Society resident within the respective districts. The Committee, at any meeting to be called by the Convener for that purpose, shall fix such general regulations as they may consider proper; and they will in particular fix the place and day of Competition, and the quantity of Butter to be produced by Competitors as a fair specimen. It is suggested as proper to be required, that a firkin made in each of the three months of July, August and September, shall be exhibited. The quality of the Butter to be tested by judges to be named by the Committee, in the way usually done by purchasers in the public market. In the event of two or more competing lots being deemed equal in quality, the premium will be awarded to the larger quantity. Although not required as a condition, it is strongly recommended, as affording facilities for sales, that the Butter should be packed in firkins, containing 56 lb. each, or in earthen vessels which have not been glazed with preparations of lead, and of such size as may be suitable for sales.—The successful candidates, before receiving the Premiums, are required to transmit to the Secretary a detailed report of the whole process followed by them in the manufacture of their Butter. Reports of the award of the Premiums in the First and Second Districts, to be lodged with the Secretary of the Society, on or before the 10th December 1837.

James Traill, Esq. of Ratter; in his absence William Horne, Esq. of Scouthell, and James Sinclair, Esq. of Forss, or either of them, to be Conveners in the First District; Robert Bruce, Esq. of Simbister, to be Convener in the Second District; and H. Home Drummond, Esq. of Blairdrummond; in his absence J. Burn Murdoch, Esq. of Coldoch, to be Convener in the Third District.

§ I. MAKING CHEESE.

I. SWEET OR FULL MILK CHEESE.

DISTRICT.

The County of Stirling, including the Parishes of Cumbernauuld and Kirkintulloch, in Dumbartonshire.

The sum of Fifteen Sovereigns will be placed at the disposal of the members of the Society in the above district, Five Sovereigns more being provided by the gentlemen of the district, or by any local association therein, to be divided and apportioned in such manner as to the respective Committees shall seem best for the improvement of Cheese-making in the said district, in 1837, under the regulations after mentioned.

CONDITIONS.

The Cheese to be made of any variety which the competitor may consider best and most suitable for the market, and the quantity made by the Competitor of each variety intended for Competition, shall not be less than one cwt. (112 lb., of 16 oz.). Each competitor shall lodge with one or other of the Conveners of the Committee a memorandum specifying the kinds of Cheese for which he is to compete; and a declaration must also be lodged with one of the Conveners, that the cheese produced is a fair average sample of the kind competing, made in that year by the competitor; and one of the cheeses of the successful specimens shall be transmitted to the Secretary for the inspection of the Society.

It is expected that intending Competitors shall communicate their intention to the Conveners, that they may have it in their power to inspect the Dairies if they think proper; and the successful competitors before receiving payment of their Premiums, are required to transmit to the Society a detailed report of the whole process employed by them in the manufacture of their cheese, and specifying the quantities of cheese made by them of the description offered for competition, the object being not to produce a few superior cheeses, but to improve the system, which, in some districts in Scotland, where premiums have been given, has been found to have attained great perfection,—as well as to ascertain the general quantity of superior cheese to be procured from the district competing. The cheeses to be examined, and the premiums awarded, by the Local Committee at such places as the Society's Members shall appoint, at a meeting in each district, to be intimated by the Conveners for that purpose; and which meetings shall also name a Committee for fixing such farther regulations as may be necessary, and arranging all details. In fixing farther regulations, the Committee will specify the quantity of Cheese to be produced by Competitors as a fair sample, and it is suggested to the Committee to obtain from the competitors, where practicable, information as to the expense of the manufacture, and the price obtained for the cheese in the market. Reports of the awards of the premiums to be transmitted to the Secretary of the Society on or before the 10th December 1837.

H. Home Drummond, Esq. of Blairdrummond, and William Murray, Esq. of Polmaise, or either of them; in their absence J. Burn Murdoch, Esq. of Coldoch, to be Conveners.

CLASS VIII.

COTTAGES.

1. PREMIUMS FOR THE BEST KEPT COTTAGES AND GARDENS.

DISTRICTS.

1. *The County of Lanark.*
2. *The County of Fife.*
3. *The County of Mid-Lothian.*
4. *The County of Selkirk.*

In order to encourage Cottagers to keep their cottages and gardens neat and clean, the Society will give to any four parishes in each of the said counties, the sum of Two Sovereigns to each parish annually, or to any Local Association, comprehending at least one parish within the object of its operations, for four successive years, on receiving a satisfactory guarantee from each of these parishes, for an equal sum, being placed at the disposal of the Society, for the same purpose, and during the same period. The guarantees for the Counties of Lanark and Fife, to be lodged with the Secretary by the 1st January 1838, and the Premiums in these counties to be competed for in that and the three following years. The guarantees for the parishes in the Counties of Mid-Lothian and Selkirk, to be lodged by 1st January 1839, and the Premiums for these counties to be competed for in that and the three following years. If guarantees shall be lodged from more than four parishes in any of these counties, within the time limited, the preference shall be given to those which have been first received.

PREMIUMS.

1. For the best kept Cottage in each of the said parishes—Two Sovereigns.
2. The second best kept ditto—One Sovereign.
3. For the best kept Cottage Garden in each parish—One Sovereign.

CONDITIONS.

The names of intending Competitors must be intimated to a Convener to be appointed by the Society, on or before the 20th of April in each year, otherwise they shall not be allowed to compete. The inspection of the *Cottages* to take place between 12th June and 12th August.

In order to authorize the awarding of the Premiums, the annual value of the Cottage of the Competitor, with the ground annexed, must not exceed L.5 Sterling, and there must at least be two Competitors in the district. No Cottage Garden for which a Premium has been awarded by the Society, will be

in competition again for the same or a lower premium. If the Cottage competing is occupied by the proprietor, the roof must be in good repair. If the roof is of thatch, it must be in good repair, though in the occupation of a tenant. The windows must be free of broken glass, and perfectly clean, and must afford the means of ventilation. Dung-hills and all other nuisances must be removed from the front and gables. The peat-stacks, if any, must be so placed as not to be a deformity; and the interior of the Cottage must be as cleanly kept as the nature of the Cottage admits of. In awarding the Cottage premiums, the preference will be given to those who, in addition to these requisites, have displayed the greatest taste in ornamenting the exterior of their houses, with the ground in front and at the gables.

In estimating the claims of competitors for the Garden Premium, the Judges will have in view, 1st, The sufficiency and neatness of the fence; The cleanness of the ground, and neatness of the walks; 3d, The quality of the crops, and general productiveness of the Garden; and 4th, The choice of Crops. Much advantage is derived in some districts in Scotland, from Cottagers cultivating, besides the more common crops, a portion of early potatoes along with the late, of early cabbage, early pease, cauliflower, lettuce, with some gooseberry and currant bushes, and a fruit tree trained against the wall, &c.

Reports stating that the various particulars before mentioned have been attended to, the number of competitors, the names of the successful parties, and the nature of the exertions which have been made by them, must be transmitted by the Conveners to the Secretary of the Society on or before the 10th day of October in each year.

Note.—Similar premiums will be given, on the same conditions, in the counties of East Lothian and Orkney and Zetland in 1840.

2. MEDALS TO COTTAGERS.

In the view of giving still farther encouragement to Cottagers of the above description, who do not reside in the counties in which the regular premiums are in operation, and, at the same time, of giving aid to local associations and public-spirited individuals, establishing or continuing, at their own expense, premiums for the like object, the Society will give its Cottage Medal to such associations or public-spirited individuals as apply for the same, and may be desirous to add that testimony of approbation to such premiums as they themselves bestow. The number of Medals to be issued annually is limited to six.

Applications for these Medals, stating the nature and amount of the encouragement which is to be afforded by the parties applying, to be made to the Society on or before the 1st of July in each year, so that the Association or individual making the application may be enabled to intimate that the Medals are to be given. The Medals will afterwards be issued upon a Report, certified in the terms required by the preceding conditions, describing the merits of the Cottagers. The Reports to be lodged

with the Secretary before the 10th November of the year in which the application is made.

3. PREMIUMS TO COTTAGERS FOR PROMOTING ATTENTION TO THE
CULTIVATION AND MANAGEMENT OF BEES.

DISTRICTS.

1. *The County of Orkney and Setland.*
2. *The Counties of Selkirk and Peebles.*

To the Cottager in the first District paying L.5 of rent or under, or whose cottage, and land annexed to it, does not exceed that annual value, who, between the 1st of June and 1st October 1837, shall have raised the greatest number of Hives of Bees, not fewer than Seven, from stocks of his or her own property, none of the hives weighing under 20 lb. exclusive of the weight of the material of the hive or skep—A premium of Four Sovereigns.

To the Cottager in the same district who shall have raised the second greatest number, as aforesaid—Three Sovereigns.

To the Cottager in the same district who shall have raised the third greatest number—Two Sovereigns.

To the Cottager in the same district who shall have raised the fourth greatest number—One Sovereign.

Certificates of the number of Hives, and their several weights, making allowance for the weight of the skeps (which must be weighed before being used), signed by two Members of the Society resident in the neighbourhood, or by one Member and the Clergyman of the parish, to be transmitted to the Secretary on or before the 10th November 1837.

Similar premiums will be given in the Second District for Hives raised between the 1st June and 1st October 1838.

CONVENERS FOR ORKNEY—Captain Balfour of Elwick—Thomas Balfour, Esq. Younger of Elwick, M. P.—James Baikie, Esq. of Tankerness, and William Traill, Esq. of Woodwick.

CONVENER FOR ZETLAND—Sir Arthur Nicolson of Lochend, Bart.—John Bruce, Esq. Younger of Sumburgh—Robert Bruce, Esq. of Simbister—William M. Cameron Mowat, Esq. of Garth, and William Hay, Esq. of Laxfirth.

In order that the Premiums offered may be made known to the industrious Cottagers, the Society trusts much to the obliging co-operation of the Clergy in the Counties in which the Cottage Premiums are in operation.

CLASS IX.

WOODS AND PLANTATIONS.

1. HONORARY PREMIUM FOR EXTENSIVE PLANTING.

To the Proprietor who shall, within a period of five years immediately preceding, have planted on his property the greatest extent of ground, not being less than 500 acres, and who shall communicate to the Society, on or before the 10th of November in any year, a satisfactory report of his operations, embracing the expense, description of soil, age, and kind of Trees planted, the number of each sort per acre, mode of planting, extent of "beeting up," and general progress of the plantation, with such observations as his experience may suggest—The Gold Medal.

2. REPORTS ON RECENT PLANTATIONS.

To the Proprietor who shall communicate to the Society, on or before the 10th of November in any year, the most satisfactory Report on the Planting of Land, founded on experiment; and who shall, accordingly, have planted on his own property an extent of not less than Fifty acres, within a period of seven years preceding the date of his Report—The Gold Medal.

The Report should comprehend every interesting particular; among others, the exposure and altitude of the place, and general character of the soil—the mode of fencing and of planting adopted—the kind of trees planted, and the number of each kind per acre—their relative progress—the proportion of blanks or deaths at the end of three years—the state of the plantation at the date of making the Report, and the expense per acre, as nearly as can be calculated.

3. NATIVE FIR WOODS.

For the best and approved account of any of the Districts of Scotland where the *Pinus sylvestris* is indigenous, and abounds so as to constitute a native forest—The Honorary Silver Medal.

The Society has already received a Report on the Glenmore, Duthill, Rothiemurchus, and Abernethy Forests, which will be forthwith published in its Transactions. Competitors will avoid giving the same information as is there contained.

It will be expected that a view should be given both of the past

and present state of the woods to which the Report has reference, and of the nature of the situations, and of the *soil* and *subsoil* where the trees appear to thrive best. It will be desirable also that measurements of some of the largest trees should be given, and a statement of their age, as far as it can be ascertained, by counting the rings or annual layers on felled trees of similar dimensions. The comparative growth of any other native trees which occur in the district, such as Birch or Oak, should be mentioned, and the undergrowth and general state of the pasture-herbage should be described. Any circumstances which may appear to the writer likely to throw light on the growth and management of native fir woods should be adverted to; and, in particular, how far the observation is well-founded, that the best trees have a northern exposure, or are found in woods having a north aspect or inclination.

4. FIR PLANTATIONS.

For the best and approved account of the Fir Woods in any District of Scotland to which the *Pinus sylvestris* is not indigenous, including the various particulars above mentioned—The Honorary Silver Medal.

5. COLLECTING THE SEEDS OF THE SCOTS FIR OR *PINUS SYLVESTRIS* FROM NATIVE TREES IN SCOTLAND.

To the Person in Scotland who shall, between 30th October 1836 and 30th October 1840, have collected and sown, or sold for sowing, the greatest quantity of Seeds of the Scots Fir or *Pinus sylvestris* from healthy and free growing trees of natural growth in the Highland districts of the Counties of Aberdeen, Moray, Inverness, or Perth, the quantity to be not less than 1500 lb. clean seeds—The Gold Medal, or a Piece of Plate of that value.

Competitors to transmit to the Secretary of the Society, on or before the 10th of November 1840, a declaration in support of the collection of the seed from proper trees, specifying the quantity collected in each year, and the district where it was gathered, stating also whether the seed had been sown or sold, and in the latter case the name of the purchaser. The expense of collecting, and if sold, the price obtained, should likewise be reported.

6. IMPORTING THE SEEDS OF THE *PINUS SYLVESTRIS*, COLLECTED FROM TREES IN THE NATIVE FORESTS OF THE CONTINENT.

To the Person in Scotland who shall, between the 30th of Oc-

tober 1836, and the 30th of October 1840, have imported from Germany or Switzerland, or from Norway, Sweden, or Russia, and sown, or sold for sowing, the largest quantity of the Seeds of the *Pinus sylvestris* (Kiefer, or Föhre, or Röför), taken from full grown healthy trees in these countries, but in no case from trees situated in the immediate vicinity of the sea, the quantity not to be less than 1500 lb. of clean seeds—The Gold Medal, or a Piece of Plate of the same value.

Competitors to transmit to the Secretary of the Society, on or before the 10th November 1840, evidence (the best that can be obtained) in support of the collection of the seeds from proper trees, specifying the District where it was collected, and the Commercial Firm through whose means it was imported; also whether it had been sown in this Country by the Importer, or sold for that purpose, and, in the latter case, the name of the purchasers. The cost price, and, if sold, the price obtained, to be also stated.

7. INTRODUCTION OF NEW FOREST TREES INTO SCOTTISH PLANTATIONS.

To the person who shall, on or before the 30th of October in any year, report to the Society the introduction into forest or ornamental Plantations of any new species of Forest Timber or ornamental Tree, suited to the climate of Scotland—The Honorary Silver Medal, or a Piece of Plate of such value as the communication may be adjudged to deserve.

Satisfactory evidence will be required, that the tree introduced is new to the plantations of Scotland, and congenial to its soil and climate. A particular account of the tree, including the manner in which it is raised, and its after management, or the condition in which it grows spontaneously, together with the circumstances which led to its introduction, must be furnished. The number planted to be specified, and a specimen of the wood must accompany the report, if the reporter be able to furnish it, or at all events, a specimen of a branchlet of the tree.

8. INTRODUCTION OF FOREST TREES NOT YET KNOWN IN A LIVING STATE IN SCOTLAND.

To the person who shall, in any year, most successfully transmit to the Society, in a state fit for germination, Seeds of Forest Trees not yet in cultivation in this country, and which are natives of such places as, from their latitude or altitude, may be expected to produce trees hardy in the climate of Scotland—The

Gold or Silver Medal, or a Piece of Plate of such value as the Directors in the circumstances of the case may think suitable.

The Society would particularly wish to direct (but by no means to confine) attention to the Fir tribes; and the countries from which contributions are particularly expected are the north-west part of America, the table-land of Mexico, such parts of the Andes as have sufficient elevation, and the Himalaya Mountains, or the great plains to the northward of them. The seeds may be sent home in the cones, wrapped in brown paper, packed in a box, and kept in a cool airy part of the cabin, but by no means in the hold, nor in tin cases. If competitors possess the means, by themselves or their correspondents, of trying their vegetation in this country, it will be desirable that they should do so; but, otherwise, if the seeds be sent to the Secretary of the Society, they will be tried under the direction of the Society, so as to afford every chance of success. The transmission of living plants in boxes, or in cases covered with glass panes, may be attempted, where practicable: the external air should be excluded, and almost no water given during the voyage. Where this plan is adopted, smaller seeds, berries, or heps, may be thickly mixed with the soil or earth in which the plants are placed.

9. MORE EXTENDED INTRODUCTION OF KNOWN SPECIES OF THE FIR TRIBE.

To the person who shall, within three years from 1835, inclusive, have introduced from any part of the world, cones containing seeds capable of germination, the produce of hardy species of the Fir Tribes which have been already introduced into Britain, but of which only a few plants have been raised—The Gold or Silver Medal, or a Piece of Plate of such value as the Directors may, in the circumstances of the case, deem adequate.

It is required that the quantity of cones of each species imported shall be sufficient to afford at least 500 seedling plants, and farther, that before the Premium be awarded, the number of seedling plants of each species actually raised in Scotland shall not be less than 100. Attention is particularly directed to *Araucaria imbricata*, *Pinus ponderosa*, *Lambertiana*, and *Sabiniana*; to *Abies Douglasii*, *nobilis*, *grandis*, and *Menziesii*; and to *Taxodium sempervirens*, which last is abundant in the vicinity of St Francisco, and throughout the low sandy plains of California.

CLASS X.

GENERAL SHOW OF LIVE STOCK,

AND

AGRICULTURAL MEETING AT DUMFRIES IN 1837.

The Highland and Agricultural Society of Scotland having resolved to hold the General Show of Live Stock and Agricultural Meeting for 1837 at Dumfries, the following Premiums are offered to be then awarded by the Society, aided by the liberal Donations made by the counties of Dumfries, Kirkcudbright, and Wigton, and by the town of Dumfries :—

§ I. CATTLE.

GALLOWAY BREED.

CLASS I. For the best Bull, calved between 1st January 1832 and 1st January 1835—Twenty Sovereigns, or Plate of that value.

For the second best ditto—Ten Sovereigns.

To the *Breeder* of the best Bull in this class—The Honorary Silver Medal.

It is a condition attached to the Premiums in Class I. that the exhibitors shall be obliged to let out the Prize Bulls to serve at least Forty Cows, during the season of 1838, within such portion and at such places of the three counties of Dumfries, Kirkcudbright, and Wigton, as the Local Committee shall fix, on payment of Five Shillings for each Cow.

II. For the best Bull Stirk, calved after 1st January 1836—Ten Sovereigns.

III. For the best two fat Oxen, calved after 1st January 1834—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

IV. For the best single fat Ox, calved after the 1st of January 1833—Seven Sovereigns.

V. For the best two Spayed Heifers, fat, calved after the 1st of January 1834—Ten Sovereigns.

VI. For the best single Spayed Heifer, fat, calved after the 1st of January 1833—Seven Sovereigns.

VII. For the best breeding Cow, calved prior to the 1st of January 1835—Ten Sovereigns.

For the second best two ditto—Five Sovereigns.

VIII. For the best two Queys, calved after the 1st of January 1835—Ten Sovereigns.

For the second best ditto—Seven Sovereigns.

For the third best two ditto—Five Sovereigns.

IX. For the best lot of Stirks, calved after the 1st of January 1836, and not under one-half of those bred on the farm, nor fewer than four in number—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

ABERDEEN OR ANGUS POLLED BREED.

X. For the best fat Ox, calved after the 1st of January 1833—Ten Sovereigns.

For the second best ditto—Seven Sovereigns.

SHORT-HORN BREED.

XI. For the best Bull, of the pure short-horned breed, calved between 1st January 1832 and 1st January 1835—Twenty Sovereigns.

For the second best ditto—Ten Sovereigns.

To the *Breeder* of the best bull in this Class—The Honorary Silver Medal.

It is a condition attached to the Premiums in Class XI., that the exhibitors shall be obliged to let out the Prize Bulls to serve at least forty Cows, within the three Counties, during the season 1838, on payment of ten shillings and sixpence for each Cow.

XII. For the best Bull Stirk, calved after the 1st January 1836—Seven Sovereigns.

XIII. For the best Cow of any age—Ten Sovereigns.

XIV. For the best fat Ox, calved after the 1st January 1835—Seven Sovereigns.

XV. For the best Heifer, calved after the 1st January 1835—Seven Sovereigns.

AYRSHIRE BREED.

XVI. For the best Bull, calved between 1st January 1832 and 1st January 1835—Fifteen Sovereigns.

To the *Breeder* of the best Bull in this Class—The Honorary Silver Medal.

A similar condition is attached to the Premium in Class XVI. as above intimated in reference to Class I.

XVII. For the best Bull Stirk, calved after 1st January 1836—Five Sovereigns.

XVIII. For the best Milch Cow, calved prior to 1st January 1834—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

XIX. For the best two Queys, calved after 1st January 1835—Seven Sovereigns.

For the second best ditto—Five Sovereigns.

WEST HIGHLAND BREED.

XX. For the best fat Ox, calved after 1st January 1833—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

ANY BREED.

XXI. For the best fat Ox, of any breed, pure or cross, calved after 1st January 1833, the particulars of the breed and age being specified—Ten Sovereigns.

II. HORSES.

CLASS I. For the best Stallion, from three to twelve years old, for the improvement of the breed of Draught Horses—Twenty Sovereigns.

II. For the best Stallion, from three to twelve years old, for breeding Horses for coach or chariot—Twenty Sovereigns.

NOTE.—It is a condition attached to these two premiums, that the exhibitors shall be obliged to let out the Prize Horses for season 1838, to serve within such portion and at such places of the district as the Local Committee may fix; the number of Mares to be served not to exceed eighty, and the charge to be One Sovereign, and 2s. 6d. for each.

III. For the best Mare, not exceeding twelve years old, for breeding Draught Horses, and which shall have been at least one year in the possession of the competitor—Ten Sovereigns.

IV. For the best three-year old Draught Gelding—Five Sovereigns.

V. For the best three years-old Filly—Five Sovereigns.

§ III. SHEEP.

LEICESTER BREED.

CLASS I. For the best Tup, of the new Leicester Breed, not exceeding five years old—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

II. For the best shearling Tup of the same breed—Five Sovereigns.

It is a condition attached to the premiums for Tups in Classes 1, 2, 5, and 10, that the exhibitors shall be obliged to let out the Prize Tups to serve, within the three counties, such number of Ewes and at such hire as the practical judges of the class in which the animal is shewn shall declare to be reasonable. If the exhibitors reside within the district, he shall have preference of service for his own flock.

III. For the best pen of three Ewes, not exceeding four years old—Five Sovereigns.

IV. For the best pen of three Fat Wedders, not exceeding twenty months old—Three Sovereigns.

CHEVIOT BREED.

V. For the best three Tups, not exceeding forty-three months old—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

VI. For the best pen of ten Ewes, not exceeding six years old, selected from a regular breeding stock of not less than 200 rearing lambs of that season till the middle of July, and being kept with the rest of the stock till at least the Whitsunday preceding—Ten Sovereigns.

For the second best pen of ditto—Five Sovereigns.

VII. For the best pen of ten Gimmers, selected from a regular breeding stock of not less than 200 Ewes, and to be kept with the breeding stock till the time of the Show—Five Sovereigns.

VIII. For the best pen of five Fat Wedders, not exceeding fifty-six months old—Five Sovereigns.

IX. For the best pen of five ditto, not exceeding thirty-two months old—Five Sovereigns.

BLACK-FACED BREED.

X. For the best three Tups, not exceeding forty-three months old—Ten Sovereigns.

For the second best three ditto—Five Sovereigns.

XI. For the best pen of ten Ewes, not exceeding six years old, selected from a regular breeding stock of not less than 200 rearing lambs of that season till the middle of July, and being kept with the rest of the stock till at least the Whitsunday preceding—Ten Sovereigns.

For the second best pen of ditto—Five Sovereigns.

XII. For the best pen of ten Gimmers, selected from a regular breeding stock of not less than 200 Ewes, and to be kept with the breeding stock till the time of the Show—Five Sovereigns.

XIII. For the best pen of five fat Wedders, not exceeding fifty-six months old—Five Sovereigns.

XIV. For the best pen of five ditto, not exceeding thirty-two months old—Five Sovereigns.

CROSS BREED.

XV. For the best pen of five fat Wedders, a cross between Che-

viot Ewes and Leicester Tups, not exceeding twenty months old—Five Sovereigns.

For the second best ditto—Three Sovereigns.

XVI. For the best pen of five fat Wedders, a cross between the Black-faced Ewes and Leicester Tups, not exceeding twenty months old—Five Sovereigns.

XVII. For the best pen of five fat Wedders, of any cross, under thirty-two months old—Five Sovereigns.

XVIII. For the best pen of ten Lambs, from Cheviot Ewes, by Leicester Rams, dropt subsequently to 1st March 1837, and shewn by the breeder—Five Sovereigns.

XIX. For the best pen of ten Lambs, from Black-faced Ewes by Leicester Rams, dropt subsequently to 1st March 1837, and shewn by the breeder—Five Sovereigns.

XX. For the best pen of ten Lambs, from Cheviot or Black-faced ewes, by any other description of ram than the Leicester, dropt subsequently to the first March 1837, and shewn by the breeder. The ram to be shewn along with the lambs—Five Sovereigns.

§ IV. SWINE.

CLASS I. For the best Boar, not under twelve months, and not exceeding four years old—Eight Sovereigns.

For the second best ditto—Five Sovereigns.

II. For the best breeding Sow, not under twelve months, and not exceeding four years old—Six Sovereigns.

For the second best ditto—Four Sovereigns.

III. For the best two Pigs, not exceeding forty weeks old—Five Sovereigns.

§ V. EXTRA STOCK, IMPLEMENTS, ROOTS, SEEDS, &c.

For Extra Stock of any kind, not shewn for any of the above Premiums, and not exceeding in one lot five Cattle, or ten Sheep; and for Implements of Husbandry, Roots, Seeds, &c., Honorary Medals or Money Premiums will be awarded to the value, in the whole, of Seventy Sovereigns.

§ VI. PRODUCTS OF LIVE STOCK.

CURING BUTTER.

CLASS I. To the owner of any Dairy in the counties of Dumfries, Kirkcudbright, and Wigton, who shall have made and cured the best quality of Butter for the market, not being less than two cwt., during the season 1837—Five Sovereigns.

For the second best quality of ditto—Three Sovereigns.

MAKING CHEESE.

II. To the person in the counties of Dumfries, Kirkcudbright, or Wigton, who shall produce the best specimen of sweet or full milk Cheese, made of any variety that he finds most profitable for the market—Five Sovereigns.

For the second best ditto—Three Sovereigns.

The whole quantity of the variety of Cheese produced, made by each Competitor during the season, must not be less than one cwt. ; and a declaration taken before a Justice of the Peace must be lodged, that two or more Cheeses produced are a fair average of the kind competing, made in that year by the Competitor.

III. To the owner of any Dairy in the counties of Dumfries, Kirkcudbright, or Wigton, who shall have made for sale the best quality of Cheese from skimmed milk, not being less than one cwt. during the season 1837—Five Sovereigns.

For the second best quality of ditto—Three Sovereigns.

In the event of two or more competing lots being deemed equal in quality, the Premium will be awarded to the greater quantity.

§ VII. SWEEPSTAKES.

Sweepstakes of One Guinea each are proposed in each of the various descriptions and ages of Stock above described, to close and name before the meeting, according to the regulations to be afterwards agreed on. The Stock entered for the Premiums may be entered also for the Stakes.

§ VIII. WOOL.

CLASS I. For the best sample of Combing Wool of seven fleeces—Five Sovereigns.

II. For the best ditto of Short Wool of the Cheviot Breed of seven fleeces—Five Sovereigns.

III. For the best sample of Wool of the Black-faced Breed of seven fleeces—Five Sovereigns.

Competitors for these Premiums are required to state the number of Sheep of which the flock consisted from which the sample is taken, the gross quantity clipt, and, if sold, the price obtained and, in regard to the Combing Wool, whether it is of the New Leicester, Cotswold, or of any cross of these breeds. Competitors must have bred the Sheep from which the Wool has been obtained.

GENERAL REGULATIONS FOR THE SHOW AT DUMFRIES.

1. The competition will take place at Dumfries in the end of September or beginning of October 1837. The particular day will be afterwards intimated.

2. The Competition is open to Stock from any part of the United Kingdom.

3. The name, residence, and post-town of the Exhibitor, the name of the Breed, the number of the class in which the animals are to be exhibited, their age, and, in the case of Fat Stock, the kind of food on which they have been fed, must be regularly certified, and the certificate signed by the Exhibitor, agreeably to the form annexed, must be duly lodged fourteen days before the day of Exhibition. The pedigree of the Stock, so far as known, must also be given. A list of the stock entered will be made up by the Secretary fourteen days before the show, and no Stock will be allowed to compete which is not included in that list.—*Printed forms* of certificates may be had by application at the Society's Hall, Edinburgh; or at the office of Mr Threshie, Clerk of Supply, Dumfries.

The Secretary, or his Clerk, will be at Dumfries sixteen days before the Show, to answer inquiries, attend to details, and to receive certificates. In the mean time, certificates may be lodged with him at Edinburgh, or with Mr Threshie at Dumfries. The certificates so lodged, are not to be communicated to third parties until after they have been officially laid before the Committee by the Secretary.

4. A responsible person on the part of the Exhibitor, must attend at the Secretary's Office, at Dumfries, *on or before* the day preceding the Show, at 12 noon, to give explanation, if it should be required, to receive orders or warrants of admission for the Stock of which they are in charge, and all necessary instructions in matters of detail, at the competition. The person or persons so attending must be acquainted with the various particulars required to be certified regarding the Stock of which they are in charge, more especially the mode of feeding in the case of Fat Stock; and it shall be competent to the Committee, if they shall see fit, to require the Exhibitor, or the person in charge of the Stock, to confirm the certificates in presence of a Magistrate on the day of competition.

5. In estimating the ages above prescribed for competing Stock, the following rules are to be observed, viz.—The Age of Cattle, in all the Classes, will be calculated from the 1st of January of the year in which they were calved; of Horses from the 1st of May of the year in which they were foaled; and of Sheep from 1st of March of the year in which they were lambed.

6. It is required that the Stock shall have been *bona fide* the property and in possession of the Exhibitor, from 1st May 1837. Evidence must be produced, if desired, that the Stallions and Bulls for which Premiums are awarded, have had produce during the preceding year; provided they are four years old and upwards.

7. No cattle fed on distillery or brewers' wash or grains (which are accessible to a few competitors only) will be allowed to compete. Cows exhibited for Premiums must have had a calf, or be in calf, during the year 1837.

8. A ticket or order will be delivered by the Secretary on or before the day preceding the Show to the person in charge of each lot, for its being received into the Show Yard; and no Stock whatever can come within the premises without such warrant. One servant only for each lot can be admitted, who must afterwards continue in charge of that lot in the Show Yard. Bulls must be secured by a ring or screw in the nose, with a chain or rope attached, otherwise they cannot be admitted into the Show Yard. There are screws for temporary use, which competitors will find it convenient to provide for bulls that have not been usually ringed.

9. The distance each animal travels to the Show, and, in the case of Fat Stock, the date of being put to fatten to be mentioned.

10. A competitor may shew more than one lot in any class. It shall not be competent to enter a lot in one Class, and afterwards to withdraw it for competi-

tion in another Class, unless by directions of the Committee. An animal having already gained the first premium in his Class, at any of the Society's General Shows of Stock, which have been held at Edinburgh, Glasgow, Perth, Dumfries, Inverness, Kelso, Stirling, Aberdeen, or Ayr, is not to be shewn again in competition in the same Class, but may be exhibited as Extra Stock.

11. All persons intending to exhibit Extra Stock, must intimate to the Secretary, and describe the Stock fourteen days before the exhibition. Stock which cannot be shewn in any competing Class, may be exhibited as Extra Stock. If any lot of Fat Stock, for which a competing Class is open, is to be entered as Extra Stock, from an impression on the part of the Exhibitor that they are too young to compete in the Classes open to them, the Judges of extra Stock are directed to notice them specially, provided they possess merit.

12. The competing Stock will be classed and distinguished by *Tickets or Numbers* to be affixed to each Lot, immediately after they are placed in the Show Yard, corresponding to the list made up by the Secretary;—by this arrangement the owner's name is not known to the Judges.

13. The Committee of the Society appointed to conduct the arrangements for the Show will appoint skilful persons to act as Judges. These will be divided into sections, to judge of the Breeds and Stock with which they are best acquainted, and in order to render the inspection short, so as the public may be permitted to enter the Show Yard as early as possible. The Judges, in forming their opinion, will particularly attend to the instructions to be delivered for their guidance.

14. A Member of the Committee or of the Deputation of Directors will be appointed to attend each section of the Judges, and who, along with the Judges, shall be admitted into the Show Yard, at ten o'clock precisely. A servant provided with Tickets, upon which shall be written in legible characters "First Premium" or "Second Premium," will be in attendance on the Member of the Committee so appointed. The Judges shall immediately proceed to examine and decide on the merits of the Stock; and as soon as a Section shall determine which animal or animals are entitled to the Prizes in their respective Classes, the Member of the Committee or Deputation of the Directors shall forthwith direct the servant in attendance to affix the Prize Ticket on the animal, and the Member of the Committee or Deputation is to be responsible that they are labelled accordingly, in order that the public may have the earliest opportunity to examine the points of the prize Cattle. When the inspection is finished, the Judges shall sign and give in their Reports to the Committee, and their award shall be final, provided no valid objection is stated against the Prize animals' right to compete in their respective Classes.

15. To prevent confusion, and to afford the time necessary for placing the Stock in the Show Yard, the different lots must be brought to the ground at or before eight o'clock in the morning. On their arrival at the gate, instructions will be given as to the particular part of the Show Yard, to be occupied by each Class. The Stock will be withdrawn, and the Show Yards hut at four o'clock.

16. Persons intending to exhibit Implements, Roots, or Seeds, must communicate with the Secretary, and lodge with him a memorandum descriptive of the articles to be shewn, at least five days before the meeting.

Finally, no change can, under any circumstances, be made upon the General Regulations established by the Society for Agricultural Meetings and General Shows of Live Stock, so far as Competitors are interested, unless regularly submitted and approved of at a meeting of the Directors in Edinburgh, and duly intimated to Competitors.

His Grace the Duke of Sutherland, the President of the Society; and the Most Noble the Vice-Presidents, the Lord-Lieutenants, Vice-Lieutenants, and Conveners of the Counties, with an adequate number of the Members of the Society, to be named at the Meetings on 30th April by the three counties more immediately connected with the Show, together with the Secretaries of the Local

Agricultural Associations, have been appointed a Committee for regulating all details connected with the Agricultural Meeting and General Show of Live Stock at Dumfries. John James Hope Johnstone, Esq. of Annandale, M. P., in his absence John Herries Maxwell, Esq. of Munches, to be Convener of the Committee.

A deputation of the Directors of the Society will be at Dumfries two days before the meeting.

**FORM OF CERTIFICATE BEFORE REFERRED TO AS APPLICABLE
TO FAT OXEN.**

I near the post town of , in the county of , do certify, That my Ox, (or Oxen as the case may be) of the breed to be shewn at the General Show of Live Stock at Dumfries, for the Premium in class was bred by Mr of ; he was calved after 1st January 18 , and is now years and months old, and was fed by me on . He has not at any time been fed on distillery or brewers' wash or grains. He will have to travel on foot (or by steam or other conveyance as the case may be) miles, or thereby, from the place of feeding to the Show at Dumfries. He was first put up to fatten on or about the day of . Witness my hand this day of 1837.

(Signature of the Exhibitor.)

Any observations as to the animal's appearance, and state of flesh when put up to feed, or other particulars which the Exhibitor may think material, and more especially the pedigree, may be subjoined to the above certificate. The certificates for Breeding Stock, and for Horses, Sheep, and Pigs, will be varied in conformity to the regulations applicable to these descriptions of Stock.

If the lot has not been bred by the Exhibitor, it is particularly desired that the Breeder, if known, may be mentioned.

INSTRUCTIONS TO THE JUDGES.

1. Upon their arrival in the Show-Yard, the Judges will assemble in the apartment provided for their accommodation, until it is intimated to them that all arrangements, preparatory to their proceeding to view the Stock, are completed.

2. Without inquiry as to the names of parties or places, the Judges are to determine by reference to the *numbers* affixed to each lot by the Secretary. The Judges, in their report, will name not only those animals entitled to the Premiums, but also the others in each class which they may consider most worthy of notice.

3. The Secretary is understood to have satisfied the Committee of the regularity and correctness of the Certificates lodged, before granting the warrant for Exhibition; and the Judges, therefore, must proceed upon that evidence, without reference to any other person. They will state, however, for the information of the Committee, if any of the Stock, in their opinion, does not come within the regulations prescribed for the Competition, so that such farther inquiry may be made as the Committee may think necessary.

4. In forming their judgment, the Judges will have regard to the symmetry, early maturity, purity, size, and general qualities, characteristic of the different breeds they have to judge of; making due allowance for age, feeding, and circumstances peculiar to the cases which come before them. They shall not award Premiums for Cows, Bulls, or Heifers, which shall appear to have been fattened for the butcher, the object being to have superior animals of these descriptions, for the purpose of breeding.

5. In no case shall a Premium be adjudged unless the Judges shall deem the Lot to have *sufficient merit*; more especially if one Lot only is presented for any of the Premiums.

6. Having formed their opinion, the Judges will sign and deliver their Report; and, having done so, they are not afterwards to propose any change. In the event of a difference of opinion, the majority shall be conclusive. When the signed Report is delivered over to the Committee, the duty of the Judges shall cease, and it will devolve on the Committee finally to award the Premiums.

CLASS XI.
GENERAL SHOW OF LIVE STOCK,

AND

AGRICULTURAL MEETING AT GLASGOW IN 1838.

The Society having resolved to hold the General Show of Live Stock and Agricultural Meeting for 1838, at Glasgow, the following premiums are offered to be then awarded, aided by liberal donations from the counties of Lanark, Renfrew, Dumbarton, and Argyll, and from the City of Glasgow.

§ I. CATTLE.

SHORT-HORN BREED.

CLASS I. For the best Bull, calved between 1st January 1833 and 1st January 1836—Twenty-five Sovereigns.

For the second best ditto—Ten Sovereigns.

To the *Breeder* of the best Bull in this class—the Honorary Silver Medal.

It is a condition attached to these Premiums, that the Exhibitors shall be obliged to let out the Prize Bulls to serve at least forty Cows during the season 1839, within such portion, and at such places of the four counties of Lanark, Renfrew, Dumbarton and Argyll, as the Local Committee shall fix, on payment of Ten Shillings and Sixpence for each Cow. The owner, if resident within the District, to have a preference of service for his own Stock.

II. For the best Bull Stirk calved after 1st January 1837—Seven Sovereigns.

III. For the best Cow of any age—Ten Sovereigns.

IV. For the best Ox calved after 1st January 1836—Seven Sovereigns.

V. For the best Heifer calved after 1st January 1836—Seven Sovereigns.

AYRSHIRE BREED.

VI. For the best Bull calved between 1st January 1833, and 1st January 1836—Twenty Sovereigns.

For the second best ditto—Ten Sovereigns.

To the *Breeder* of the best Bull in this class, the Honorary Silver Medal.

A similar condition is attached to the Premiums in this class as is above intimated in reference to the Premiums in Class I.

VII. For the best Bull Stirk calved after 1st January 1837—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

VIII. For the best Milch Cow calved prior to 1st January 1835—Fifteen Sovereigns.

For the second best ditto—Seven Sovereigns.

No Cow shall be allowed to compete, unless there shall be lodged with the Secretary a declaration by the person in charge of the cow, that he had witnessed the Cow milked dry after five o'clock on the morning of the Exhibition.

IX. For the best two Queys calved after 1st January 1836—Seven Sovereigns.

For the second best two ditto—Five Sovereigns.

X. For the best two Oxen calved after 1st January 1835, shewing the most symmetry and weight—Ten Sovereigns.

WEST HIGHLAND BREED.

XI. For the best Bull calved between 1st January 1831 and 1st January 1837—Twenty Sovereigns.

For the second best ditto—Ten Sovereigns.

To the *Breeder* of the best Bull in this class—The Honorary Silver Medal.

It is a condition attached to the Premiums in this Class that the exhibitors shall be obliged to let out, in the season 1839, the Prize Bulls to serve at least forty Cows at such places in the county of Argyll as the Committee shall fix, on payment of Ten Shillings and Sixpence for each Cow. The owner, if resident within the district, to have preference of service for his own stock.

XII. For the best Bull Stirk, calved after 1st January 1837—Seven Sovereigns.

XIII. For the best Cow, of any age—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

XIV. For the best two Oxen, calved after 1st January 1834—Ten Sovereigns.

XV. For the best two ditto, calved after 1st January 1835—Seven Sovereigns.

XVI. For the best two ditto, calved after 1st January 1835, which have been never housed nor confined in a straw-yard—Seven Sovereigns.

XVII. For the best two Heifers, calved after 1st January 1835—Ten Sovereigns.

XVIII. For the best two ditto, calved after 1st January 1836—
Five Sovereigns.

XIX. For the best five Oxen, calved after 1st January 1837,
bred by the exhibitor—Ten Sovereigns.

NOTE.—Exhibitors of West Highland Stock are referred to the Premium of
the Gold Medal, offered for the Experiment referred to in the class of
Essays, No. 13, p. 19.

GALLOWAY, POLLED ANGUS, AND POLLED ABERDEENSHIRE BREEDS.

XX. For the best Ox of the Galloway breed, calved after the
1st January 1834—Ten Sovereigns.

XXI. For the best Angus Ox of the same age—Ten Sovereigns.

XXII. For the best Aberdeenshire Ox of the same age—Ten
Sovereigns.

CROSSES.

XXIII. For the best Ox, first cross of short-horn, with Ayrshire,
Galloway, Fife, West Highland, Aberdeen, or Angus stock, the
particulars of the cross being specified, calved after 1st January
1834, shewing most symmetry and weight—Ten Sovereigns.

XXIV. For the best ditto, not exceeding 36 months old—Ten
Sovereigns.

ANY BREED.

XXV. For the best Ox, calved after 1st January 1834, the par-
ticulars of the breed and age being specified—Ten Sovereigns.

§ II. HORSES.

CLASS I. For the best Stallion for the improvement of the breed
of Draught Horses, not under three and not exceeding eight years
and five months old—Thirty Sovereigns.

Evidence must be produced that the Prize Horse has had pro-
duce, and it is a condition attached to the premium, that the ex-
hibitor shall be obliged to let out the Prize Horse for season
1839, to serve within such portion and at such places of the coun-
ties of Lanark, Renfrew, and Dumbarton, as the Local Commit-
tee may fix. The number of Mares to be served not to exceed
seventy, and the charge to be One Sovereign for each. Ten of
the Mares exhibited at the Show, to be recommended by the
Judges, to have a preference of service.

For the second best Stallion—Fifteen Sovereigns.

II. For the best Breeding Mare for Agricultural purposes, not
exceeding twelve years old, and having had at least one foal—Ten
Sovereigns.

For the second best ditto—Seven Sovereigns.

III. For the best entire Colt, for Agricultural purposes, rising three years old—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

IV. For the best Filly for Agricultural purposes, not exceeding thirty-four months old—Five Sovereigns.

§ III. SHEEP.

BLACK-FACED BREED.

CLASS I. For the best two Tups, not exceeding forty-five months old—Ten Sovereigns.

For the second best two ditto—Five Sovereigns.

II. For the best pen of five Ewes, not exceeding five years and seven months old, selected from a regular breeding stock of not fewer than a hundred, and the pen having reared Lambs for the season to the 1st of July—Five Sovereigns.

III. For the best pen of five Gimmers—Five Sovereigns.

IV. For the best pen of five Dinmonts—Five Sovereigns.

V. For the best pen of five Wedder Sheep, not under one year and eight months, and not exceeding three years old—Five Sovereigns.

IV. For the best pen of five Wedders, not exceeding three years old, fed exclusively on hill pasture since twelve months old.—Five Sovereigns.

VII. For the best pen of five Wedders, four years old, fed on hill pasture since twelve months old—Five Sovereigns.

VIII. For the best pen of five Wedders, of any age, shewing most symmetry, fat, and weight—Five Sovereigns.

CHEVIOT BREED.

IX. For the best two Tups, not exceeding forty-five months old—Five Sovereigns.

X For the best pen of five Ewes, not exceeding five years and seven months old—Five Sovereigns.

XI. For the best pen of five Gimmers—Five Sovereigns.

XII. For the best pen of five Dinmonts—Five Sovereigns.

LEICESTER BREED.

XIII. For the best Tup, not exceeding forty-five months old—Ten Sovereigns.

For the second best ditto—Five Sovereigns.

XIV. For the best pen of three Ewes of any age—Five Sovereigns.

XV. For the best pen of three Wedders, not exceeding thirty-two months old—Three Sovereigns.

XVI. For the best pen of three Wedder Lambs—Three Sovereigns.

XVII. For the best pen of three Ewe Lambs—Three Sovereigns.

CROSS BREED.

XVIII. For the best pen of three three-year-old Wedders, a cross between the Black-faced and Cheviot breeds, shewing most symmetry and weight—Five Sovereigns.

XIX. For the best pen of three Dinmonts, not exceeding twenty months old, of the same cross—Five Sovereigns.

XX. For the best pen of three Wedders, a cross between Leicester Tups and Cheviot Ewes—Three Sovereigns.

XXI. For the best pen of three Wedders of any age, a cross between the Leicester and Black-faced breeds, and shewing most symmetry and weight—Five Sovereigns.

XXII. For the best pen of three Wedders, any cross, if not exceeding four years and seven months old, the cross to be specified in the certificate—Five Sovereigns.

XXIII. For the best pen of five Lambs, of any cross, with Black-faced Ewes, the cross being specified, which shall be of the greatest value to the butcher on the day of competition—Five Sovereigns.

For the second best ditto—Three Sovereigns.

XXIV. For the best pen of five Lambs, of any cross, which shall be of greatest value to the butcher, on the day of competition, the cross to be specified—Five Sovereigns.

§ IV. SWINE.

CLASS. I. For the best Boar—Five Sovereigns.

For the second best ditto—Three Sovereigns.

II. For the best Sow—Five Sovereigns.

For the second best ditto—Three Sovereigns.

III. For the best three Pigs, not exceeding forty weeks old—Five Sovereigns.

For the second best three ditto—Three Sovereigns.

In awarding these Premiums, attention will be paid to the breeds most suitable for family use. The name of the breed to be specified in the Certificate.

EXTRA STOCK, IMPLEMENTS, ROOTS, AND SEEDS.

For Extra Stock of any kind not shewn for any of the above Premiums, and not exceeding in one lot, five Cattle or ten Sheep, and for Implements, Roots, Seeds, &c., Premiums will be awarded and apportioned by the Committee and judges in Money, Plate, or Honorary Medals, to the value in whole of not less than Fifty Sovereigns.

§ WOOL.

CLASS. I. For the best sample of Combing Wool of seven fleeces—Five Sovereigns.

II. For the best ditto of Short Wool, of the Cheviot breed, of seven fleeces—Five Sovereigns.

III.—For the best ditto of Wool of the Black-faced breed of seven fleeces—Five Sovereigns.

Competitors for these Premiums are required to state the number of sheep of which the flock consisted, from which the sample is taken, the gross quantity clipped, and, if sold, the price obtained; and, in regard to the combing wool, whether it is of the New Leicester, Cotswold, or any cross of these breeds. The Exhibitors must have bred the stock from which the wool has been obtained.

§ PRODUCTS OF LIVE STOCK.

1 CURING BUTTER.

CLASS I. To the owner of any Dairy in the counties of Lanark, Renfrew, Dumbarton, or Argyll, who shall have made and cured, and shall exhibit at the Show, the best quality of butter for the market; the quantity made not being less than two cwt., during the season 1838—Five Sovereigns.

For the second best quality—Three Sovereigns.

A declaration must be lodged with the Secretary, by the party competing, that the sample produced is a fair average of the quality made and cured by the competitors, during the season 1838.

2 MAKING CHEESE.

II. To the person in the counties of Lanark, Renfrew, Dumbarton or Argyll, who shall produce the best specimen of sweet or full milk cheese, made of any variety, that he finds most profitable for the market, the quantity not being less than one cwt. of 112 lb. 16 oz. to the lb.—Five Sovereigns.

For the second best ditto—Three Sovereigns.

The whole quantity of the variety of cheese produced made by each competitor during the season must not be less than 1 cwt., and a declaration must be lodged that two or more cheese produced are a fair average of the kind competing made in that year by the competitor.

III. To the Owner of any Dairy in the Counties of Lanark, Renfrew, Dumbarton, or Argyll, who shall have made for sale the best quality of Cheese from skimmed milk, not being less than one cwt. during the season 1838—Five Sovereigns.

For the second best quality of ditto—Three Sovereigns.

These Premiums are offered under the same conditions as the Premiums in Class II.

In the event of two or more lots of Butter or Cheese being deemed of equal merit, the Premiums will be awarded to the greater quantity.

GENERAL REGULATIONS FOR THE SHOW AT GLASGOW.

The Competition will take place at Glasgow in the end of September, or beginning of October 1838. The particular day will be afterwards intimated.

The Competition is open to stock from any part of the United Kingdom.

It is required that the stock shall have been the property of the Exhibitors from 1st May 1838.

Cattle fed on distillery or brewers' wash or grains, which are accessible only to a few competitors, will not be allowed to compete for premiums in any of the Classes. Cattle fed on oil-cake are not excluded. Cows exhibited for premiums must have had a calf during the year 1838, and Cows of the West Highland breed must have suckled or fed a calf that season.

In estimating the ages of stock, the same rules are to be observed as are fixed by the 5th article of the Regulations for the Dumfries Show in 1837.

The usual Regulations of the Society with respect to Shows of this kind, in so far as applicable to the Dumfries Meeting, must be strictly adhered to; and in particular the Judges shall be instructed not to award Premiums to Cows, Bulls, or other breeding stock, which shall appear to have been fattened for the butcher—the object being to encourage such stock for the purpose of breeding. The places at which the prize Bulls and Stallions are to serve, will be fixed by the Committee.

For the other Regulations generally, intending competitors are referred to those published for the Dumfries Meeting in 1837.

THE VETERINARY SCHOOL.

The Establishment is now in its Fourteenth Session, under the Lecturer appointed by the Society, Mr Dick, a Graduate of the Veterinary College of London.—Students receive instruction in the anatomy and diseases of the horse, and other domestic animals, in the best system of treatment and cure, in stable management, and in the most approved and scientific modes of shoeing. The students are sent to the class by Local Agricultural Associations, or attend on their own account. The hour of Lecture is accommodated to the convenience of students attending the Agricultural and other classes in the University. Those students who attend two courses, and are afterwards found qualified at the annual Examination by the Committee of Medical Examinators, receive Certificates.

Mr Dick occasionally delivers a popular course of lectures to a class of gentlemen. It may be also observed, that several of the principal Lecturers in different branches of Medical Science, have for some years given free admission to their classes, to those Veterinary Students who intend to practise.

The Lectures and Demonstrations for the Session 1837–8, will be commenced in November next, at the Lecture-room in Clyde Street, Edinburgh.

SPECIMENS OF THE DIFFERENT QUARRIES AND MINES OF SCOTLAND.

The Society, considering it to be a very important step towards the attainment of a Geological and Mineralogical Survey of Scotland,—and a measure otherwise of general utility and interest,—that the nature of the Rocks and other Mineral produce should be ascertained with certainty and precision, by the collection of a complete series of specimens, to be deposited and topographically arranged for reference in its Museum, would esteem it not only as a favour to the Society, but as a public benefit to the country, if the proprietors of estates, or the owners or lessees of the quarries or mines, worked in Scotland, will cause specimens of the different Rock-formations, Ores, and other Mineral productions of their respective districts, to be transmitted accordingly to the Society's Museum, Edinburgh.

These specimens need not be more than three inches square, and

one and a half or two inches at most in thickness ; and it is desirable that each package should be accompanied by the donor's name, and a short account of the locality of the quarry or mine from which the specimens have been taken ; together with a descriptive catalogue of the specimens transmitted, each of which must have the corresponding name or number pasted upon it. If several varieties of stone, &c. are seen in the same quarry, specimens of each should be sent, numbered according to their order of succession, marking the uppermost No. 1, and thence descending in regular order with Nos. 2, 3, 4, &c. ; and their exact positions may be shewn by a rough sketch or diagram in this form.

	Soil.
No. 1.	Shale.
2.	Sandstone.
3.	Coal.
4.	Sandstone.
5.	Shale.
6.	Coal.
7.	Shale.
8.	Limestone.

Packages to be addressed to the care of Mr Slight, Curator of the Museum, at the Society's Hall.

NOTE.—The local Associations that may have been formed in different parts of the country for the encouragement of the study of Natural History, may render themselves of the greatest service in forwarding a work of so much national importance, by directing and superintending the collection and transmission of these specimens, as far as their influence may extend in the districts with which they may be respectively concerned. Any communications from them on the subject, addressed to the Secretary, will be thankfully acknowledged.

By Order of the Directors,

CHARLES GORDON, *Secretary.*

